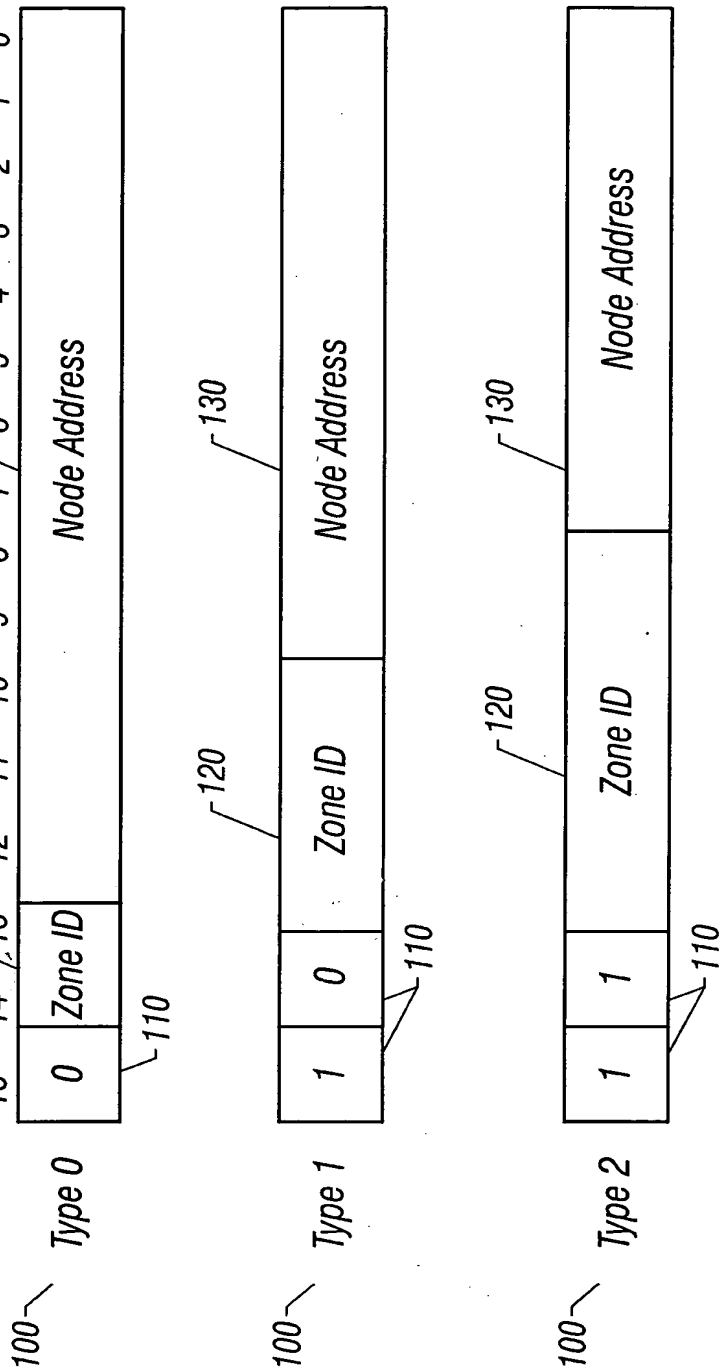

100
Type 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
0
Zone ID
Node Address
110
120
100
Type 1
1
0
Zone ID
Node Address
110
120
130
100
Type 2
1
1
Zone ID
Node Address
110
120
130

FIG. 1

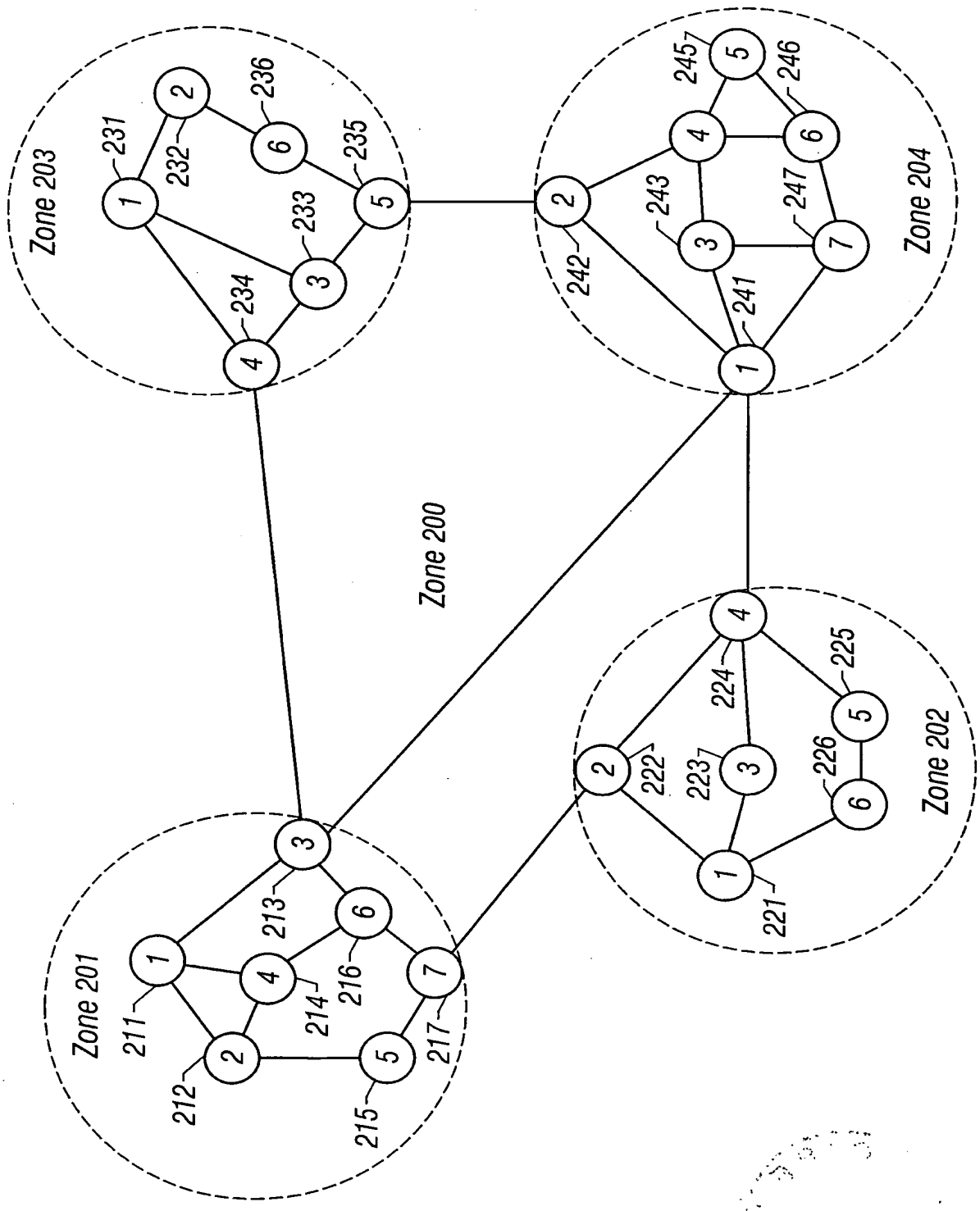

Zone 200
Zone 201
Zone 202
Zone 203
Zone 204
211
212
213
214
215
216
217
221
222
223
224
225
226
231
232
233
234
235
236
241
242
243
245
246
247

FIG. 2

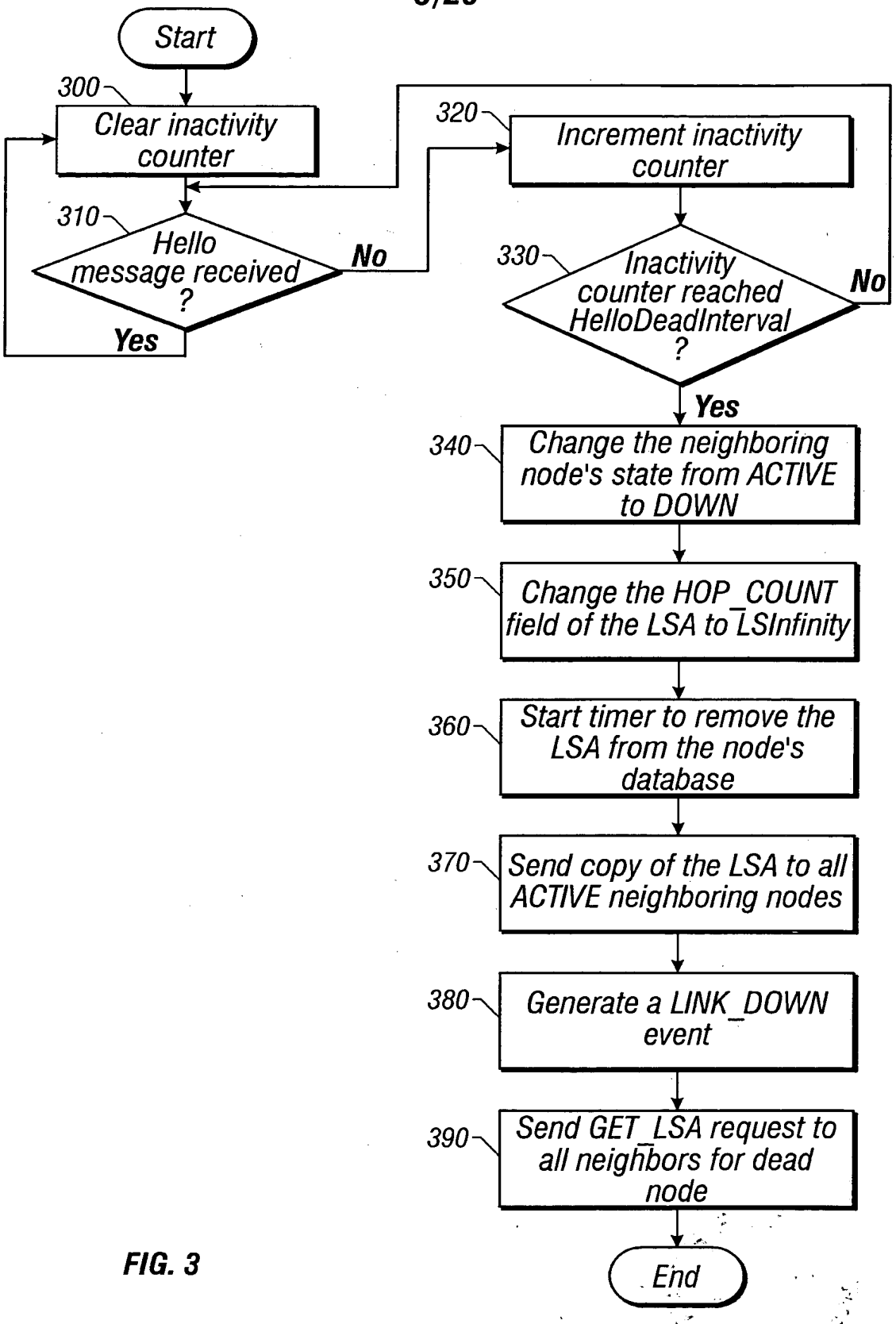

Start
300
Clear inactivity counter
310
Hello message received ?
No
Yes
320
Increment inactivity counter
330
Inactivity counter reached HelloDeadInterval ?
No
Yes
340
Change the neighboring node's state from ACTIVE to DOWN
350
Change the HOP_COUNT field of the LSA to LSInfinity
360
Start timer to remove the LSA from the node's database
370
Send copy of the LSA to all ACTIVE neighboring nodes
380
Generate a LINK_DOWN event
390
Send GET_LSA request to all neighbors for dead node
End

FIG. 3

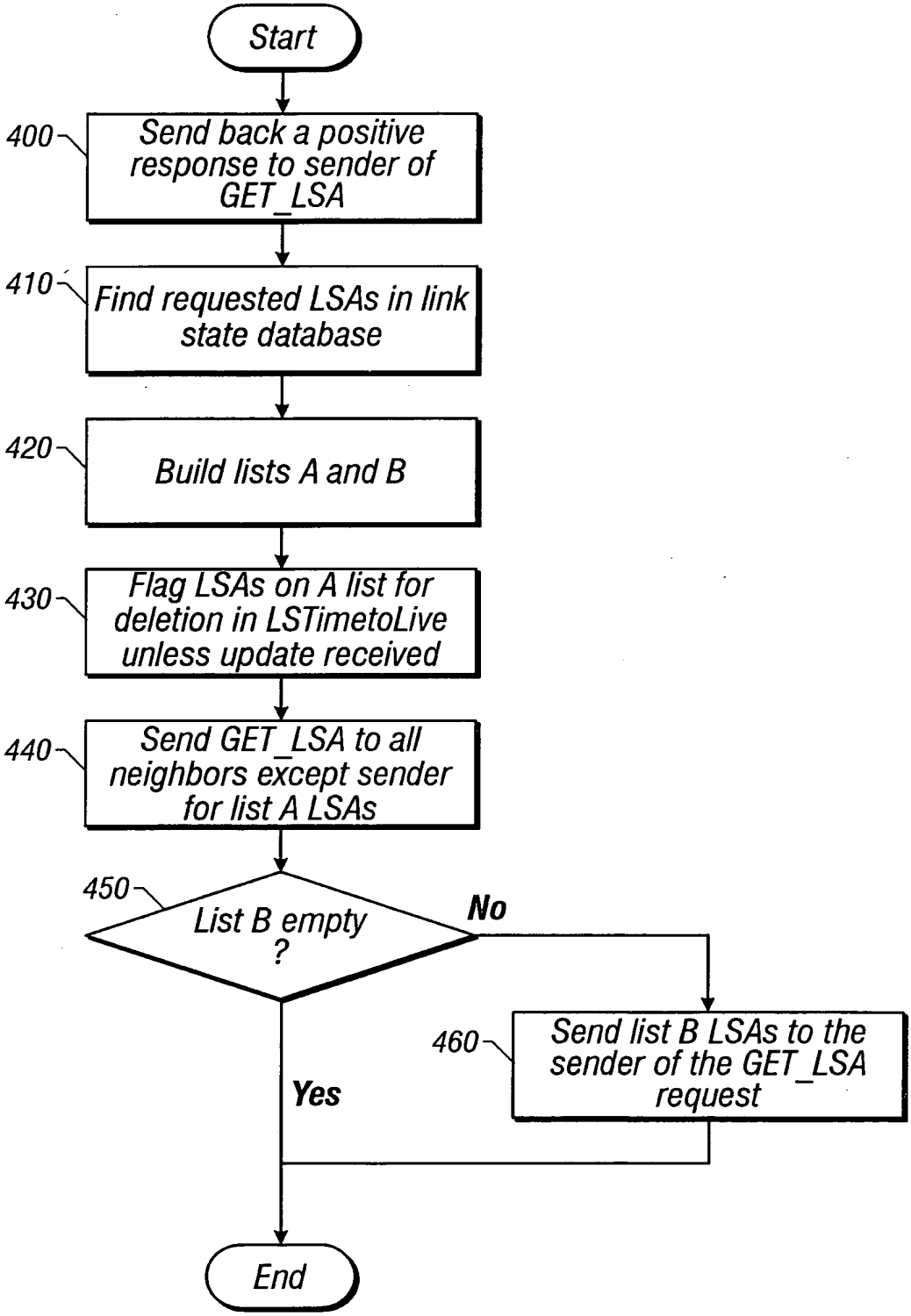

Start
400
Send back a positive response to sender of GET_LSA
410
Find requested LSAs in link state database
420
Build lists A and B
430
Flag LSAs on A list for deletion in LSTimetoLive unless update received
440
Send GET_LSA to all neighbors except sender for list A LSAs
450
List B empty ?
No
Yes
460
Send list B LSAs to the sender of the GET_LSA request
End

FIG. 4

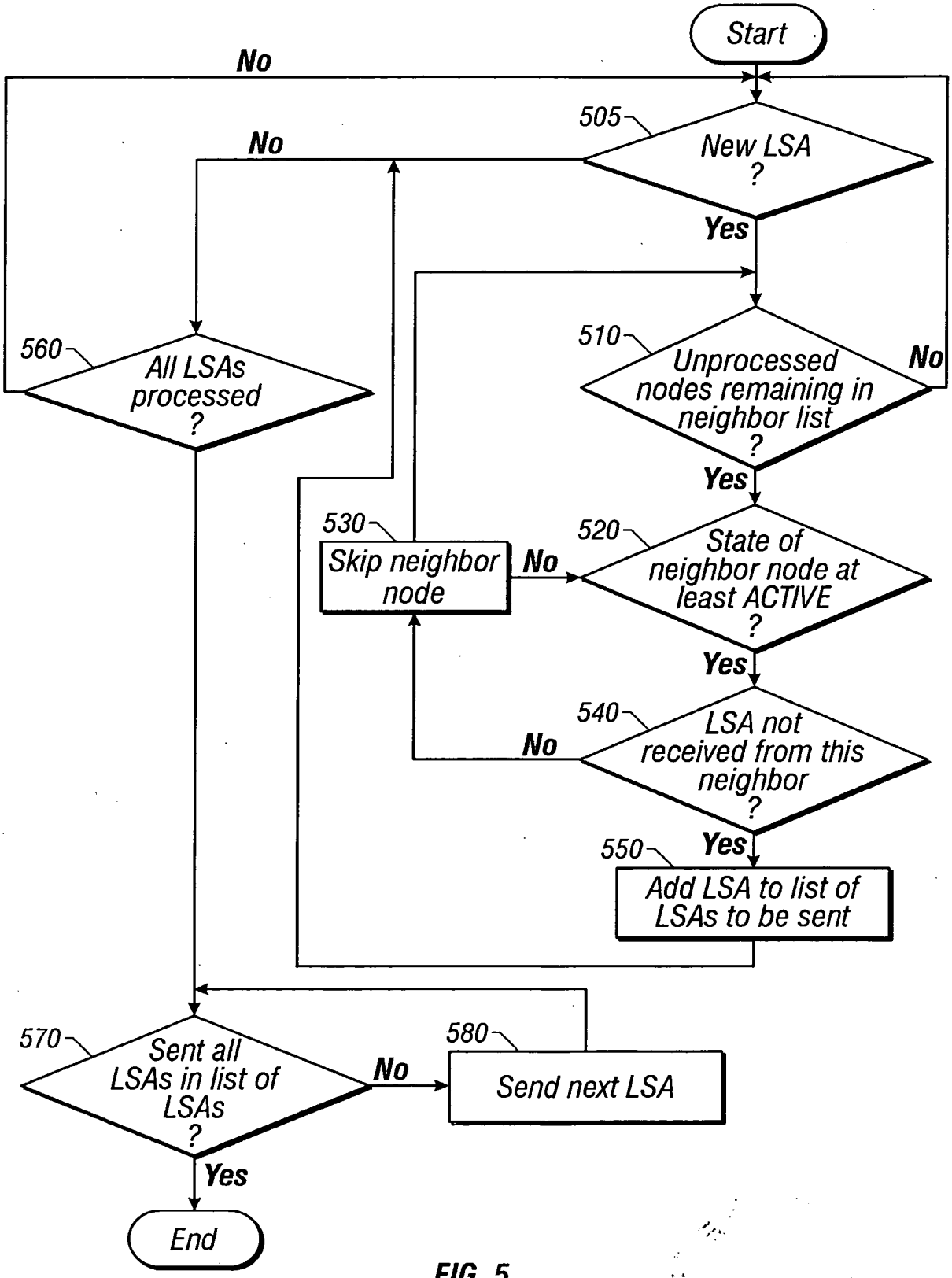

Start
505
New LSA ?
No
Yes
510
Unprocessed nodes remaining in neighbor list ?
No
Yes
520
State of neighbor node at least ACTIVE ?
No
530
Skip neighbor node
Yes
540
LSA not received from this neighbor ?
No
Yes
550
Add LSA to list of LSAs to be sent
560
All LSAs processed ?
No
570
Sent all LSAs in list of LSAs ?
No
580
Send next LSA
Yes
End

FIG. 5

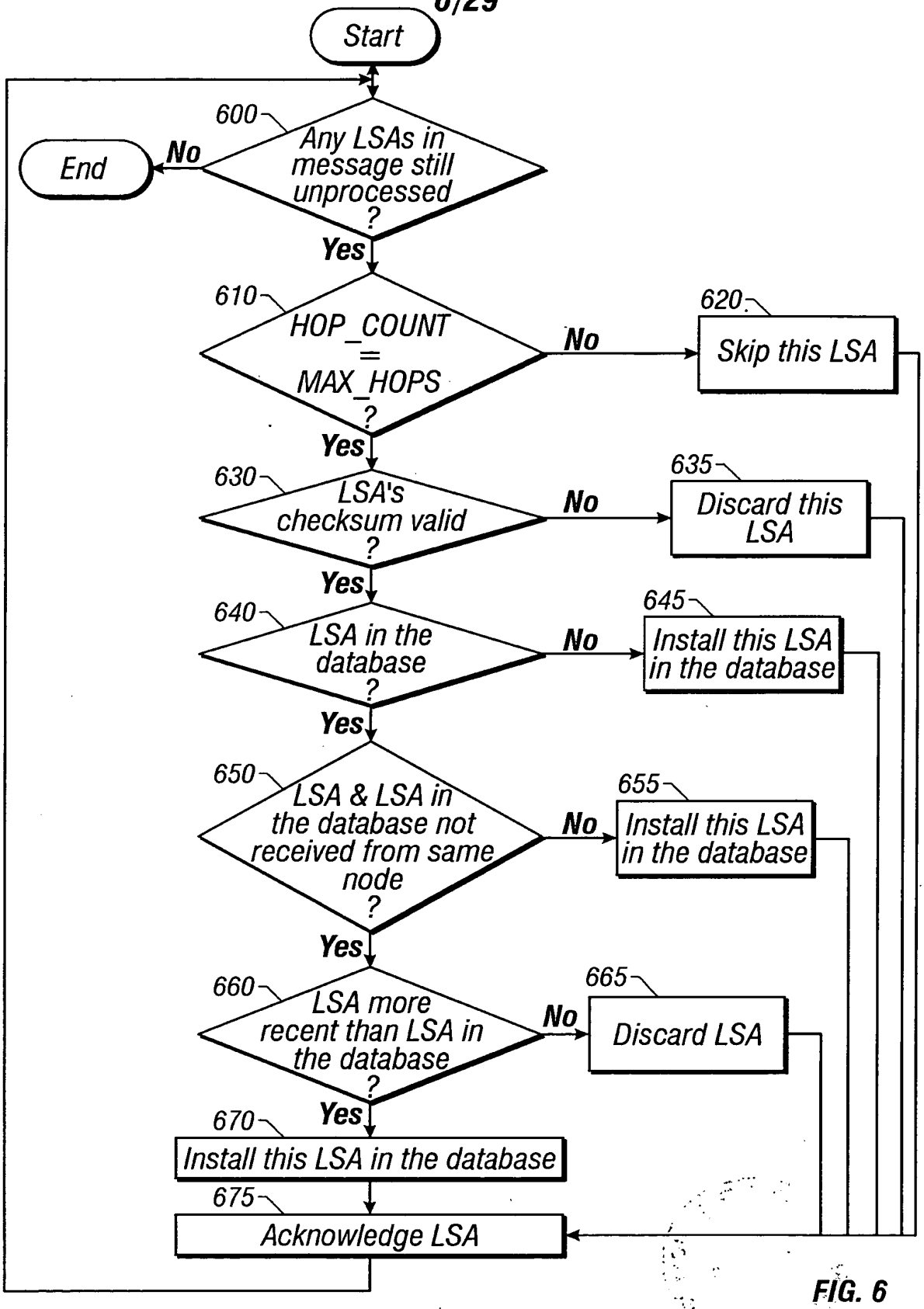

Start
600
Any LSAs in message still unprocessed ?
No
End
Yes
610
HOP_COUNT = MAX_HOPS ?
No
620
Skip this LSA
Yes
630
LSA's checksum valid ?
No
635
Discard this LSA
Yes
640
LSA in the database ?
No
645
Install this LSA in the database
Yes
650
LSA & LSA in the database not received from same node ?
No
655
Install this LSA in the database
Yes
660
LSA more recent than LSA in the database ?
No
665
Discard LSA
Yes
670
Install this LSA in the database
675
Acknowledge LSA

FIG. 6

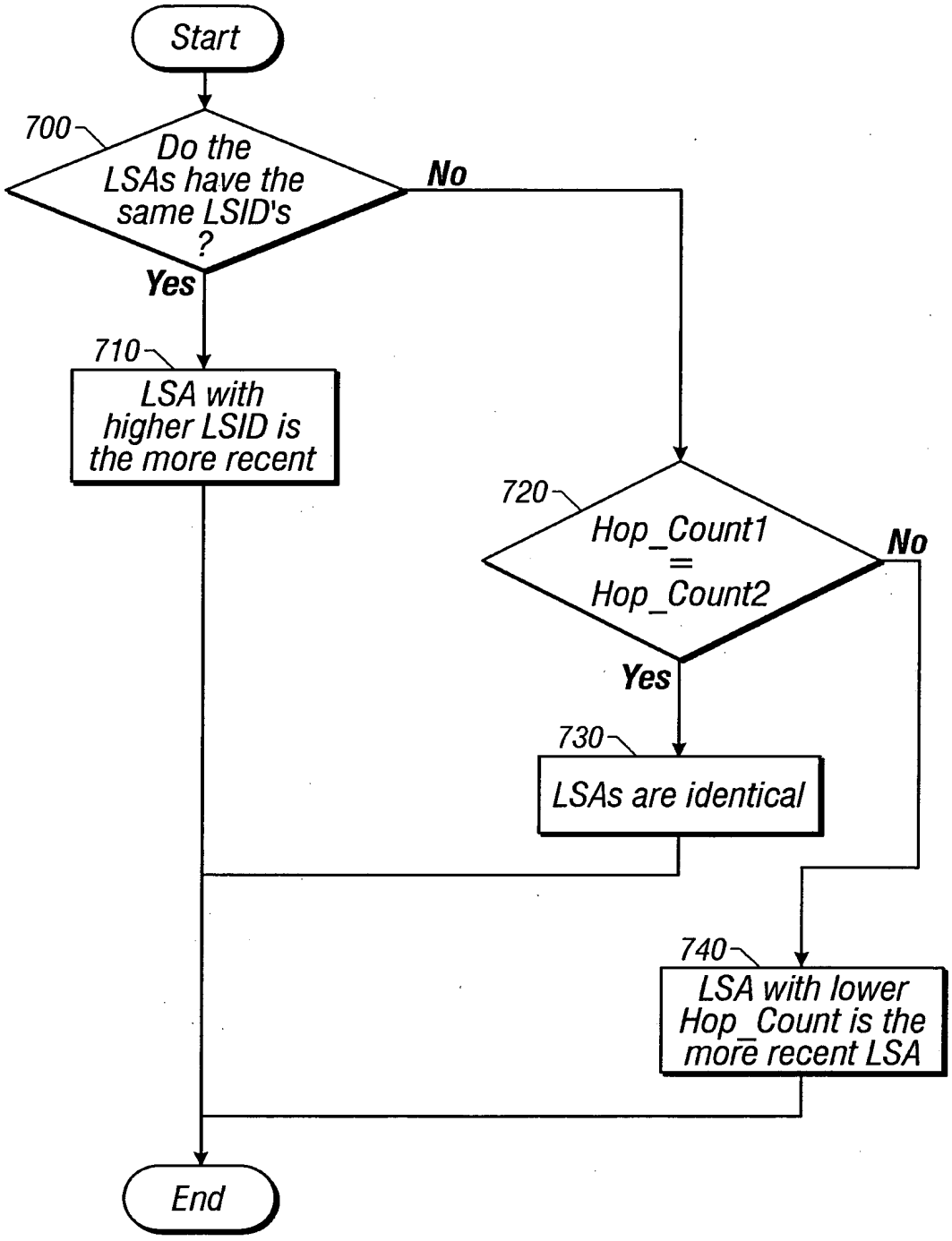

Start
700
Do the LSAs have the same LSID's ?
No
Yes
710
LSA with higher LSID is the more recent
720
Hop_Count1 = Hop_Count2
No
Yes
730
LSAs are identical
740
LSA with lower Hop_Count is the more recent LSA
End

FIG. 7

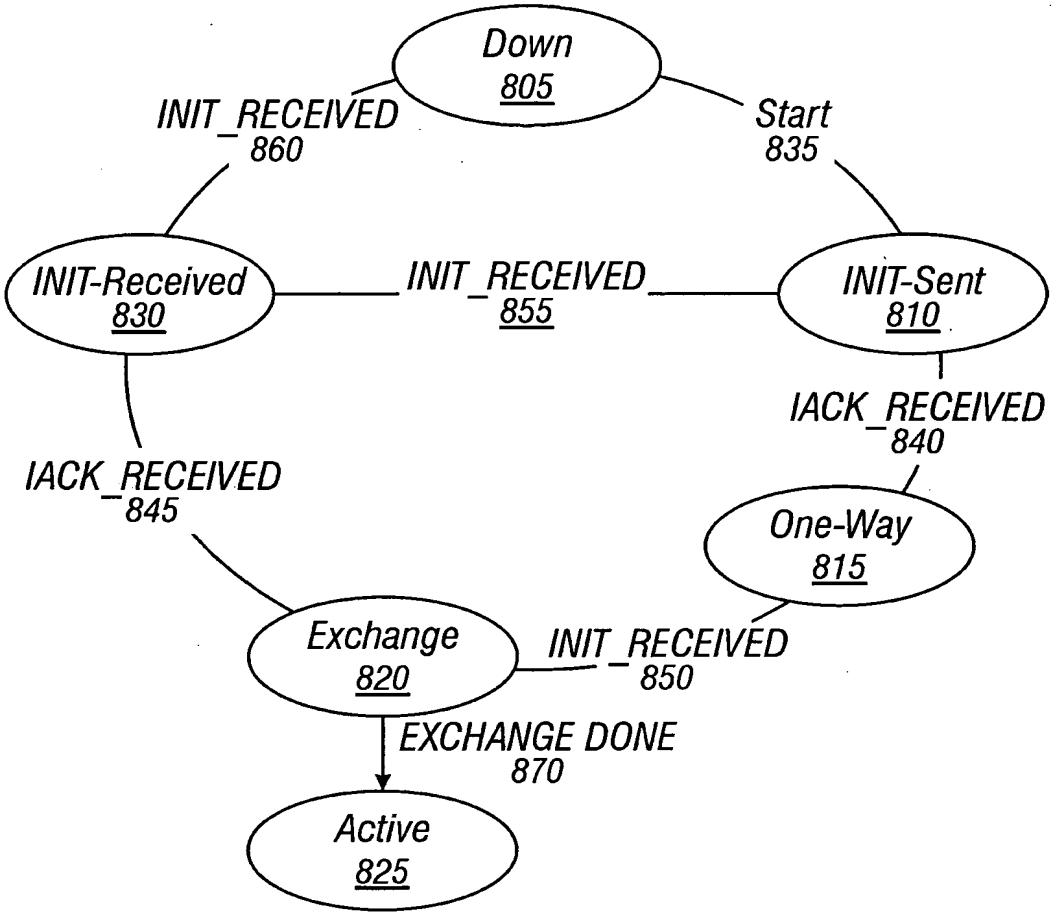

Down
805
INIT_RECEIVED
860
Start
835
INIT-Received
830
INIT_RECEIVED
855
INIT-Sent
810
IACK_RECEIVED
840
IACK_RECEIVED
845
One-Way
815
Exchange
820
INIT_RECEIVED
850
EXCHANGE DONE
870
Active
825

FIG. 8

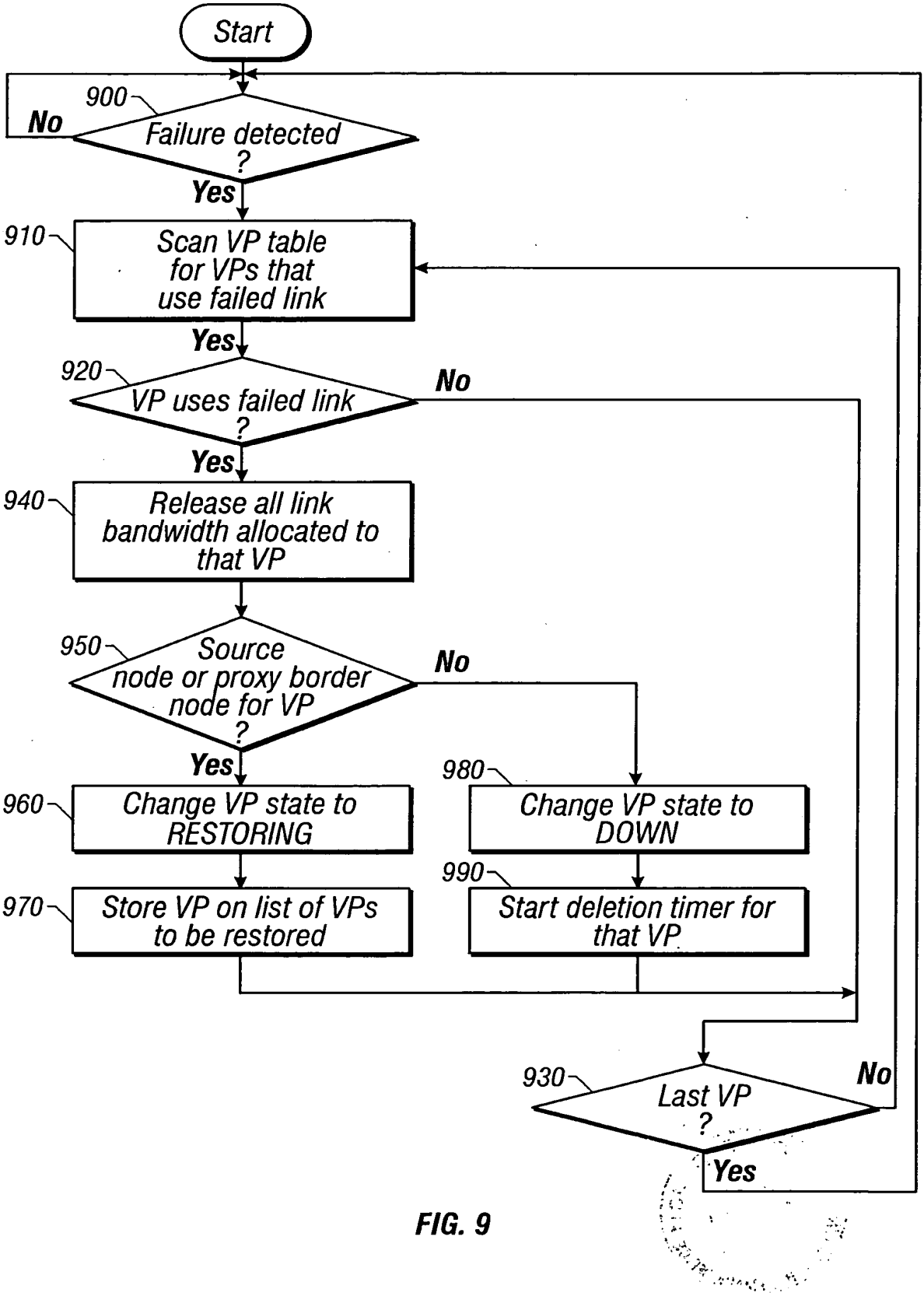

Start
900
Failure detected ?
No
Yes
910
Scan VP table for VPs that use failed link
Yes
920
VP uses failed link ?
No
Yes
940
Release all link bandwidth allocated to that VP
950
Source node or proxy border node for VP ?
No
Yes
960
Change VP state to RESTORING
970
Store VP on list of VPs to be restored
980
Change VP state to DOWN
990
Start deletion timer for that VP
930
Last VP ?
No
Yes

FIG. 9

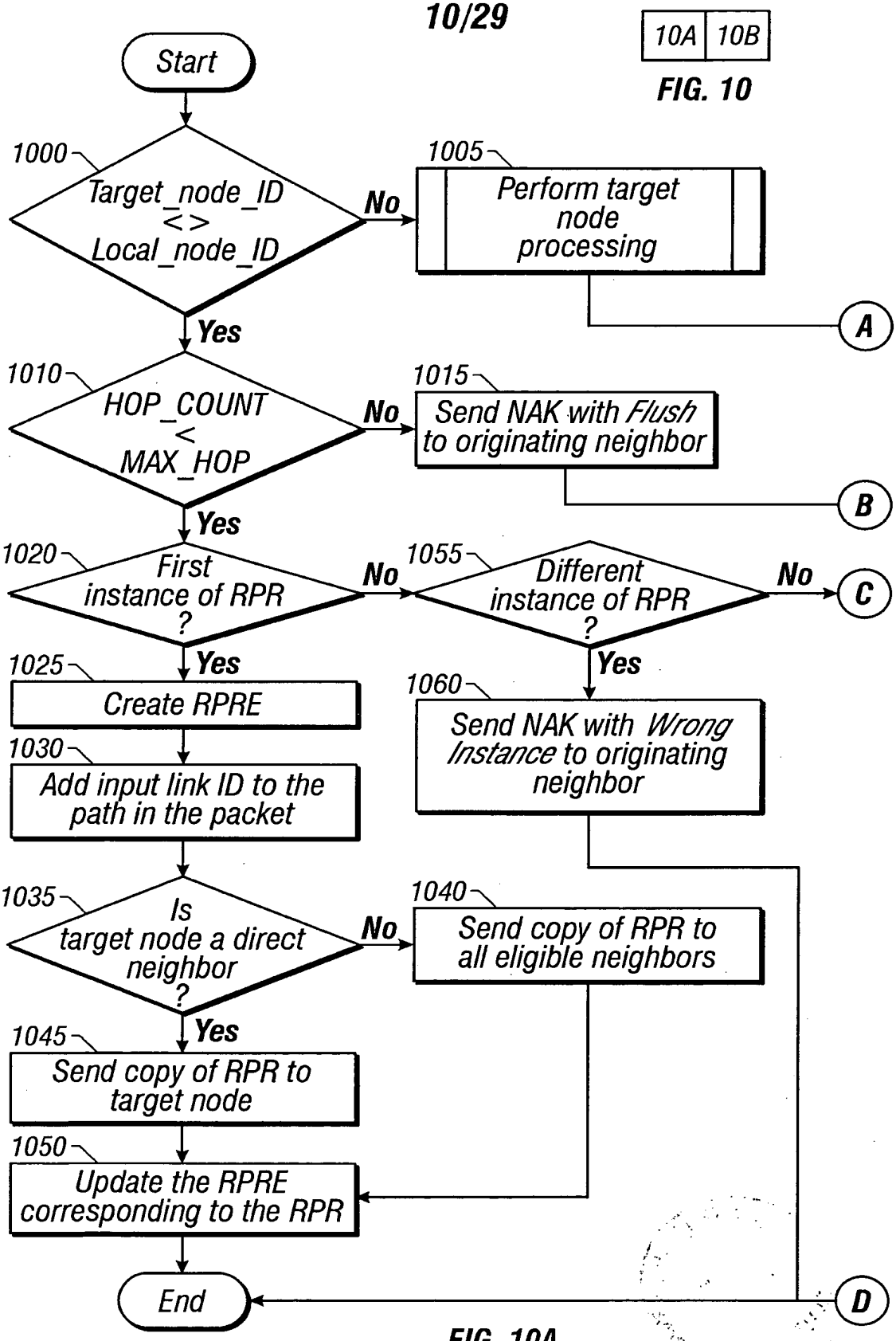


FIG. 10

FIG. 10A

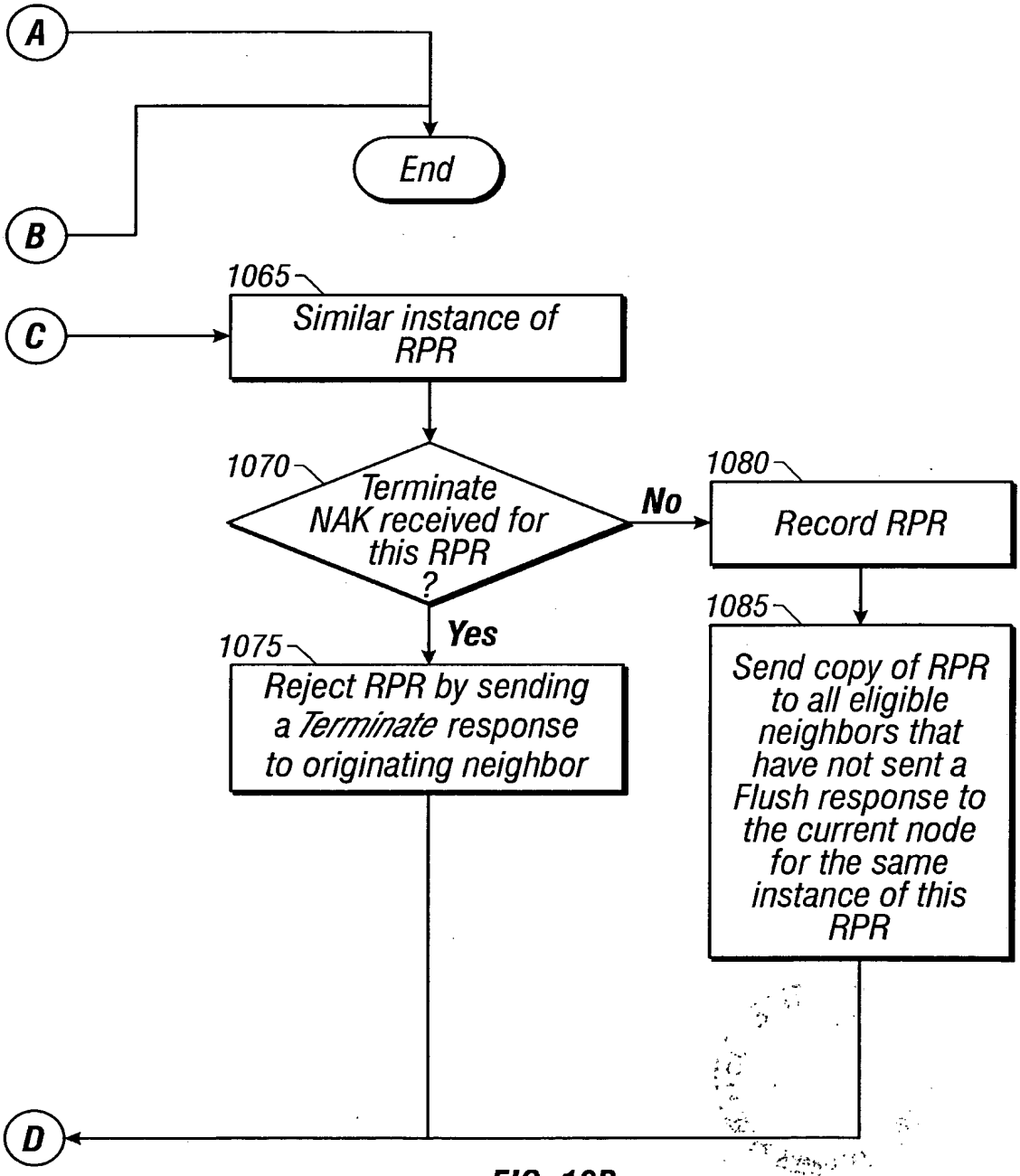
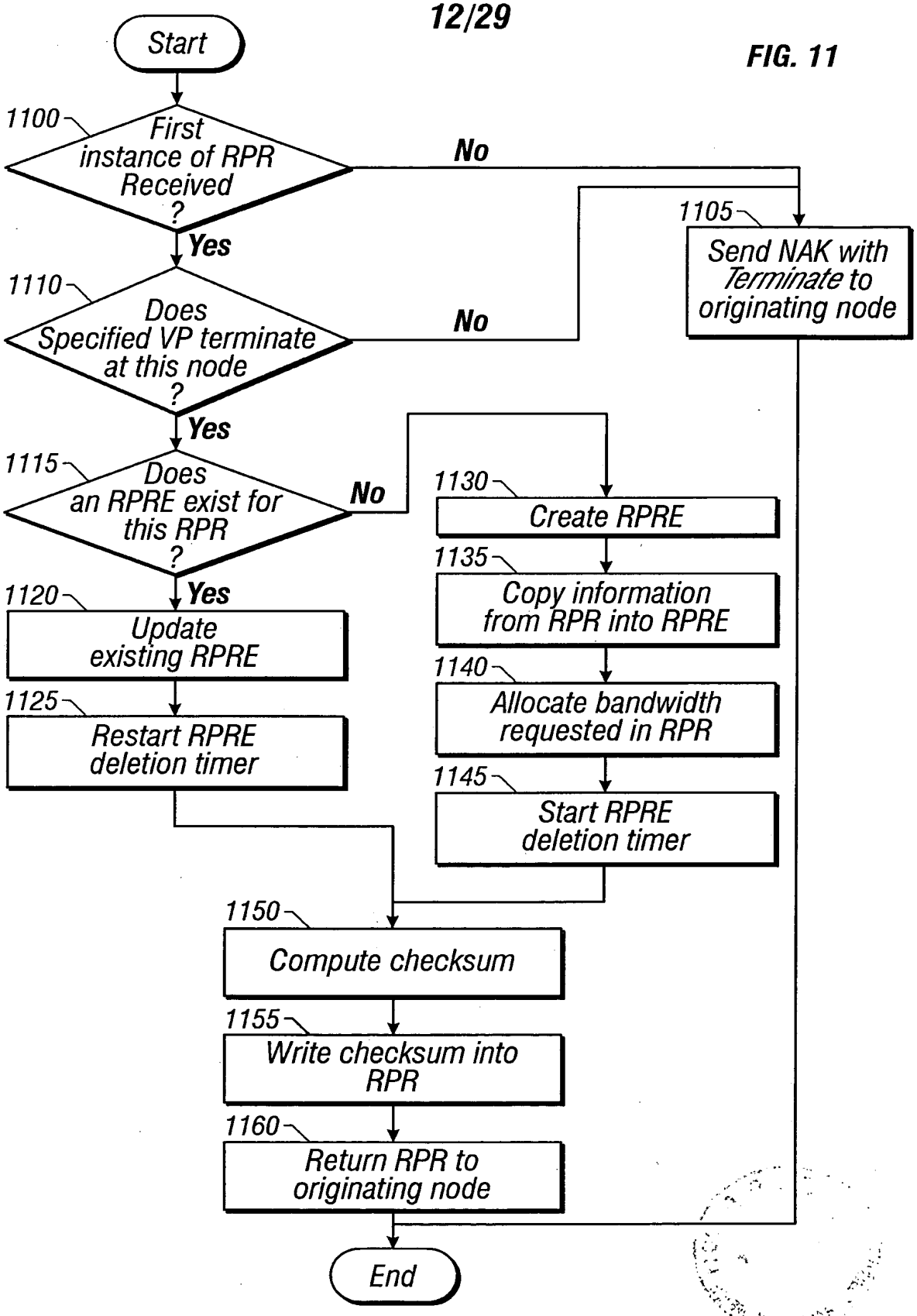

A
B
C
D
End
1065
Similar instance of RPR
1070
Terminate NAK received for this RPR ?
No
Yes
1075
Reject RPR by sending a Terminate response to originating neighbor
1080
Record RPR
1085
Send copy of RPR to all eligible neighbors that have not sent a Flush response to the current node for the same instance of this RPR

FIG. 10B

FIG. 11


Start
1100
First instance of RPR Received ?
No
Yes
1105
Send NAK with Terminate to originating node
1110
Does Specified VP terminate at this node ?
No
Yes
1115
Does an RPRE exist for this RPR ?
No
Yes
1130
Create RPRE
1135
Copy information from RPR into RPRE
1140
Allocate bandwidth requested in RPR
1145
Start RPRE deletion timer
1120
Update existing RPRE
1125
Restart RPRE deletion timer
1150
Compute checksum
1155
Write checksum into RPR
1160
Return RPR to originating node
End

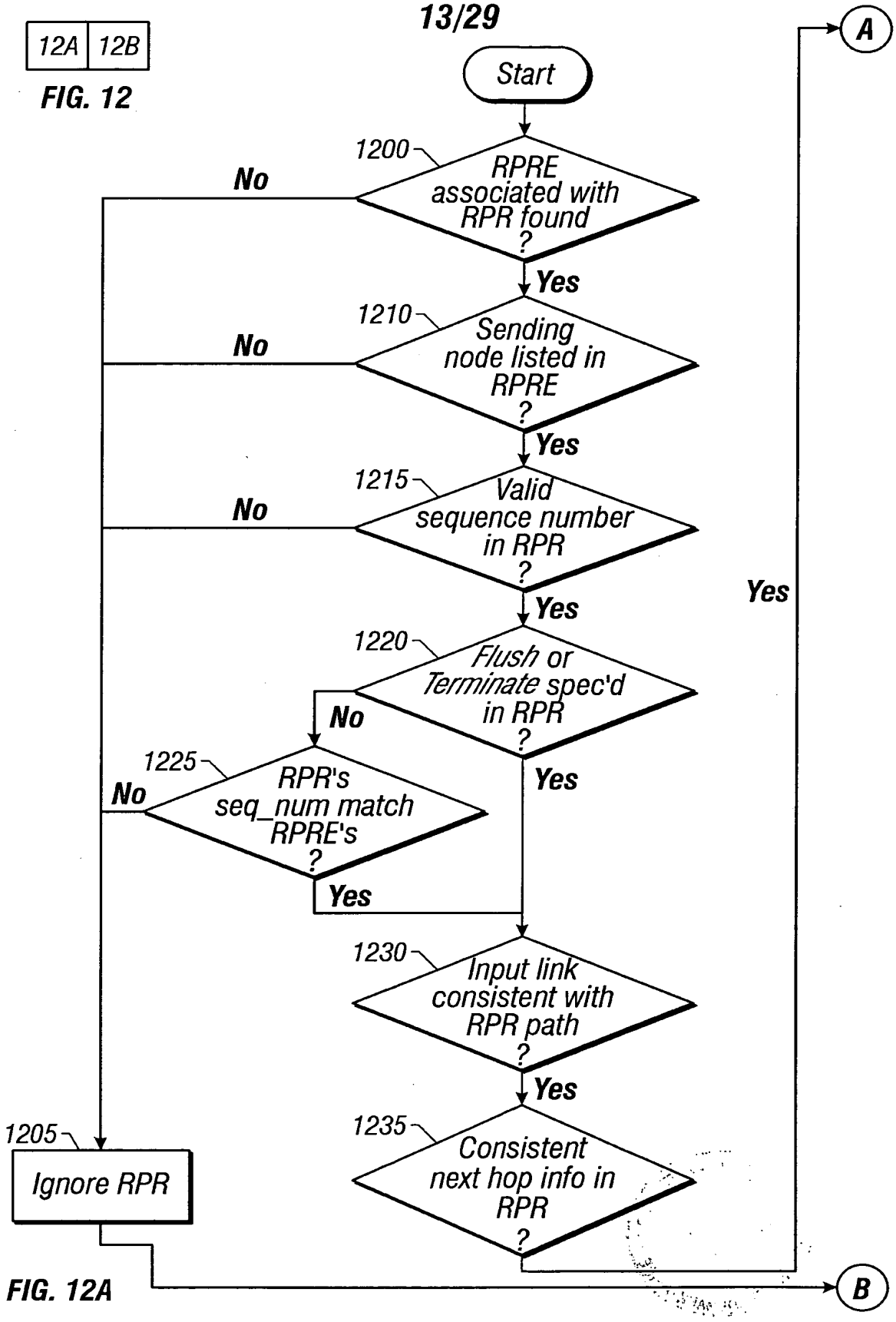


FIG. 12

FIG. 12A

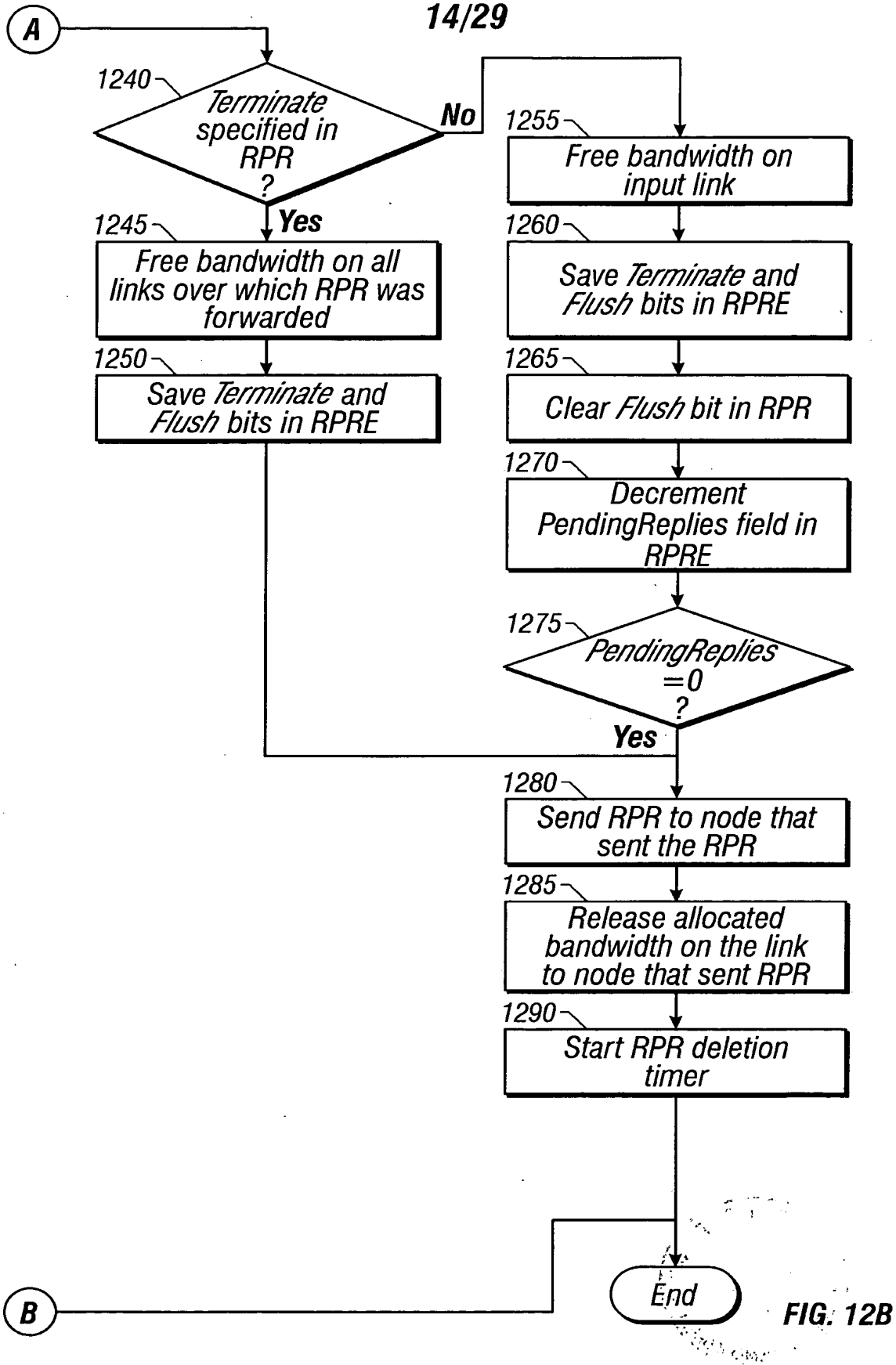

A
1240
Terminate specified in RPR ?
No
Yes
1245
Free bandwidth on all links over which RPR was forwarded
1250
Save Terminate and Flush bits in RPRE
1255
Free bandwidth on input link
1260
Save Terminate and Flush bits in RPRE
1265
Clear Flush bit in RPR
1270
Decrement PendingReplies field in RPRE
1275
PendingReplies =0 ?
Yes
1280
Send RPR to node that sent the RPR
1285
Release allocated bandwidth on the link to node that sent RPR
1290
Start RPR deletion timer
End
B

FIG. 12B

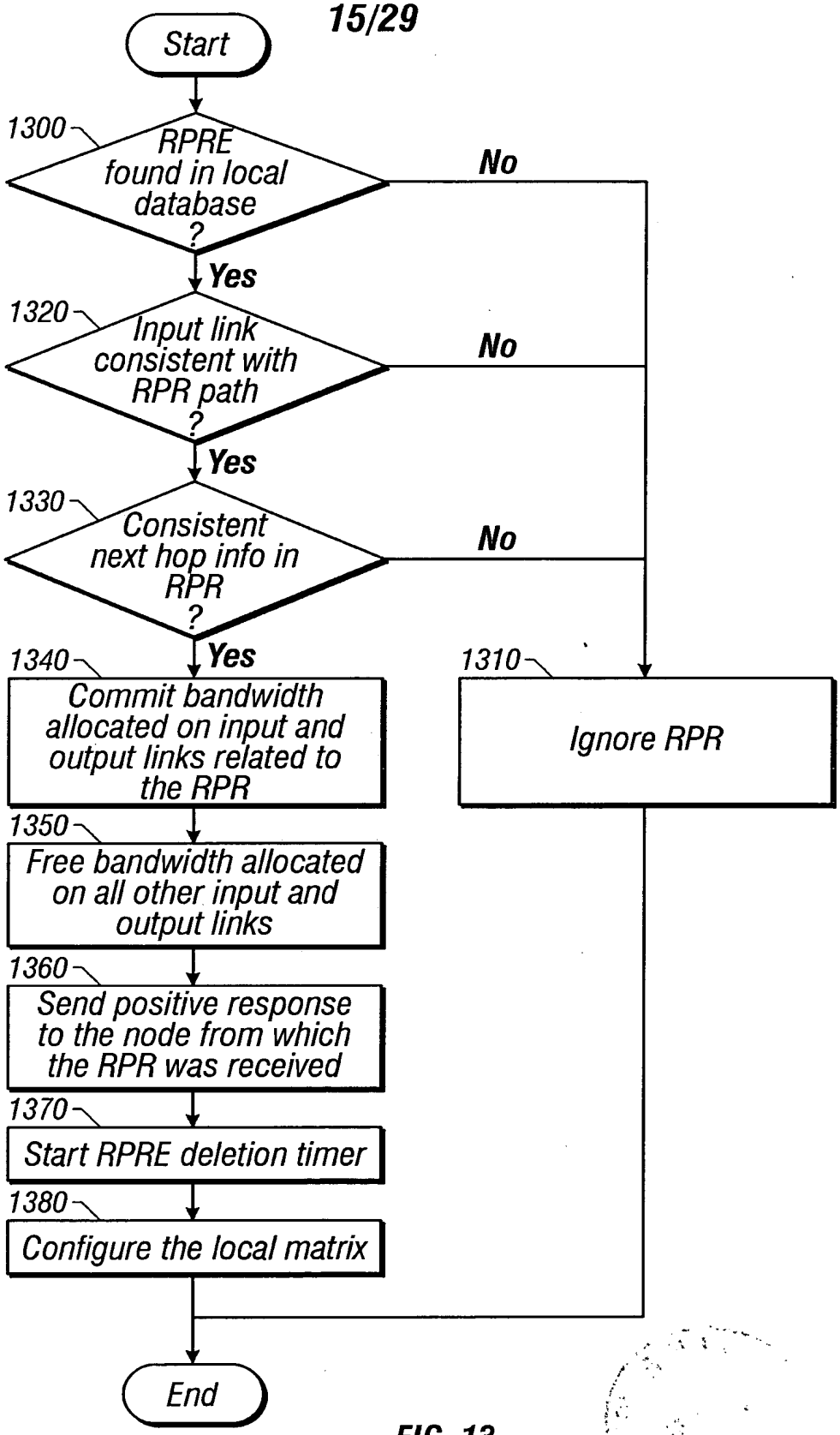

Start
1300
RPRE found in local database ?
No
Yes
1320
Input link consistent with RPR path ?
No
Yes
1330
Consistent next hop info in RPR ?
No
Yes
1340
Commit bandwidth allocated on input and output links related to the RPR
1350
Free bandwidth allocated on all other input and output links
1360
Send positive response to the node from which the RPR was received
1370
Start RPRE deletion timer
1380
Configure the local matrix
1310
Ignore RPR
End

FIG. 13

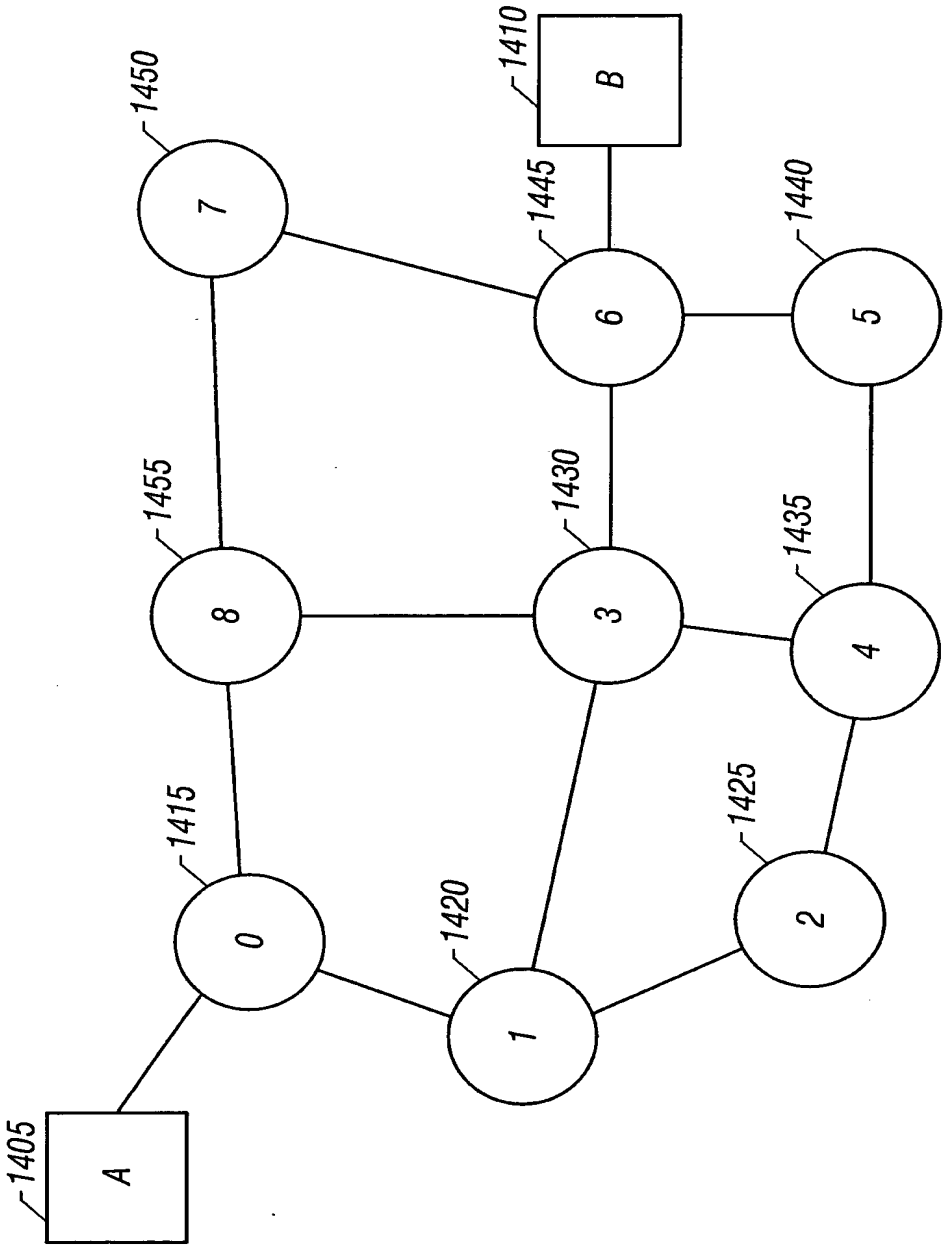

1450
7
1410
B
1445
6
1440
5
1455
8
1430
3
1435
4
1415
0
1420
1
1425
2
1405
A

FIG. 14

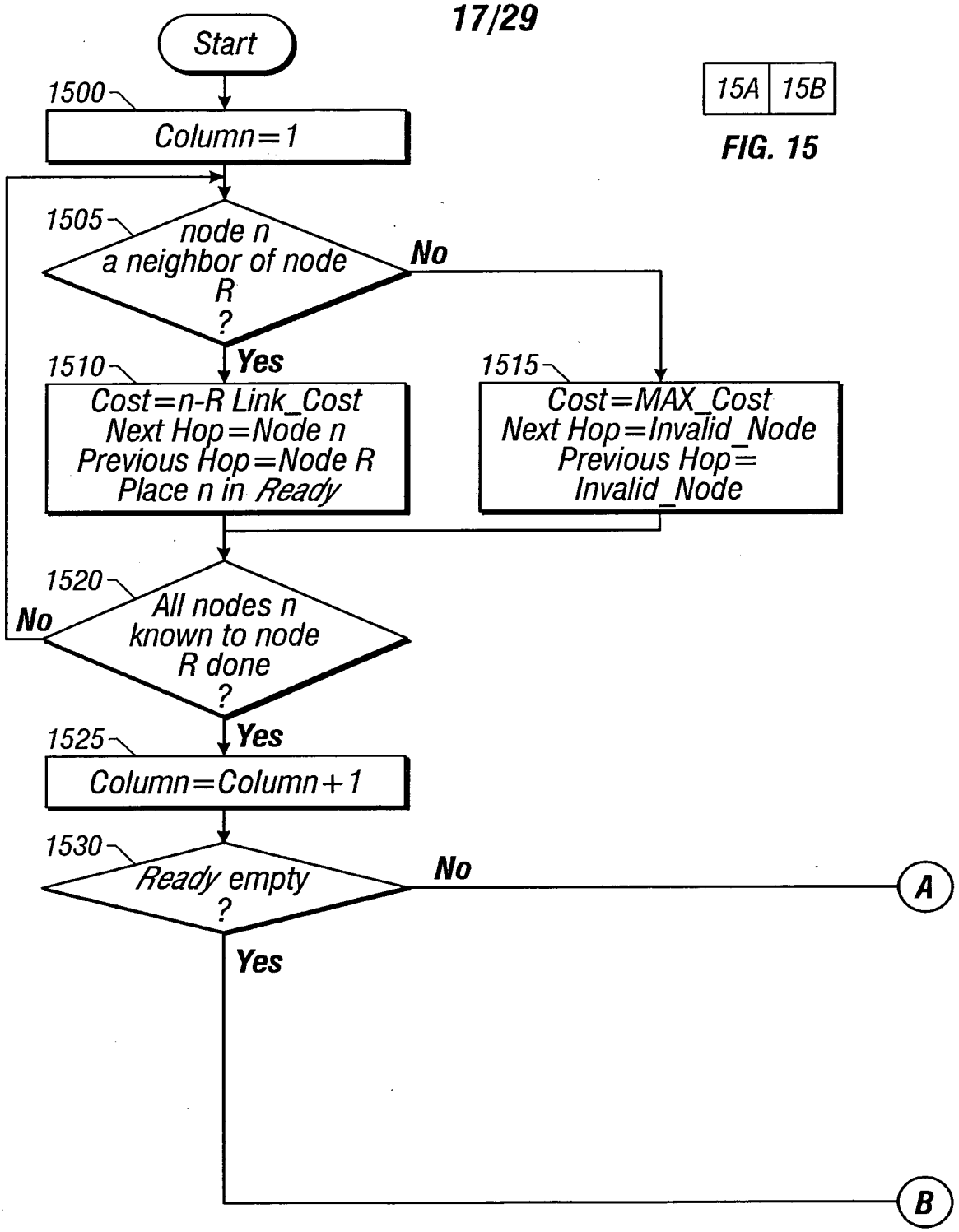


FIG. 15A

15A | 15B

FIG. 15

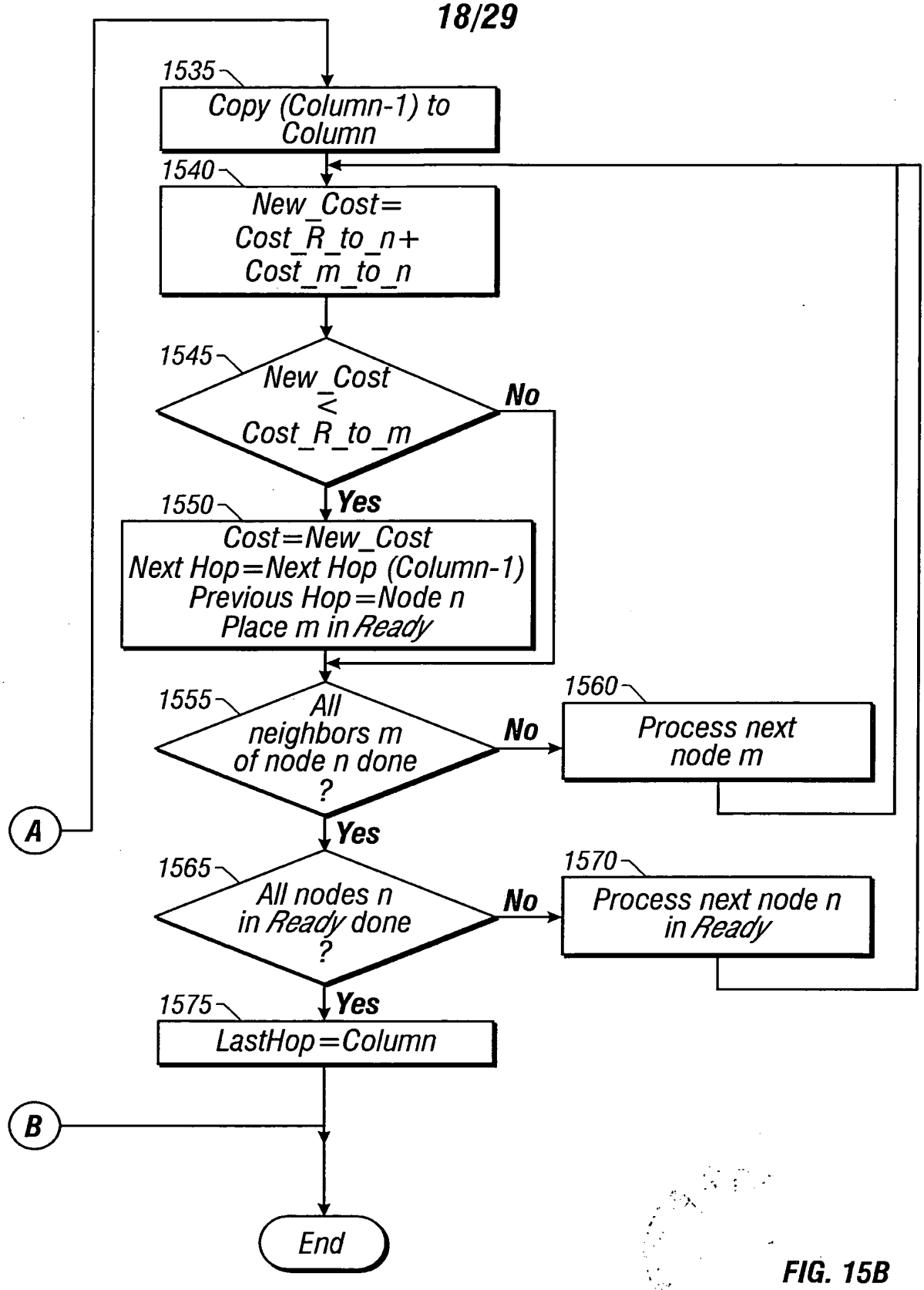

1535
Copy (Column-1) to Column
1540
New_Cost= Cost_R_to_n+ Cost_m_to_n
1545
New_Cost ≤ Cost_R_to_m
No
Yes
1550
Cost=New_Cost
Next Hop=Next Hop (Column-1)
Previous Hop=Node n
Place m in Ready
1555
All neighbors m of node n done ?
No
1560
Process next node m
Yes
1565
All nodes n in Ready done ?
No
1570
Process next node n in Ready
Yes
1575
LastHop=Column
A
B
End

FIG. 15B

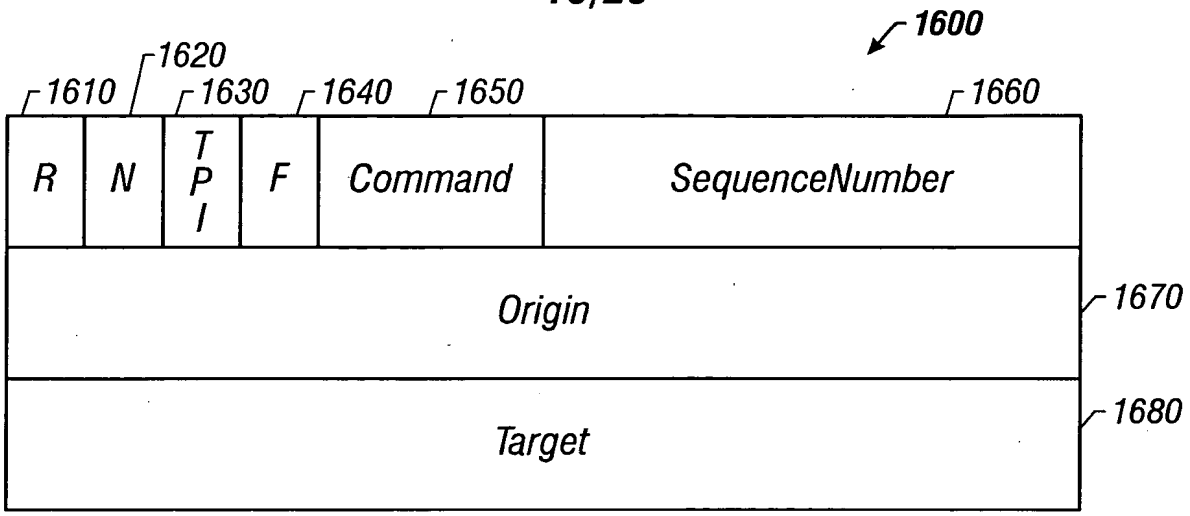

1600
1620
1610
1630
1640
1650
1660
R
N
T
P
I
F
Command
SequenceNumber
Origin
1670
Target
1680

FIG. 16

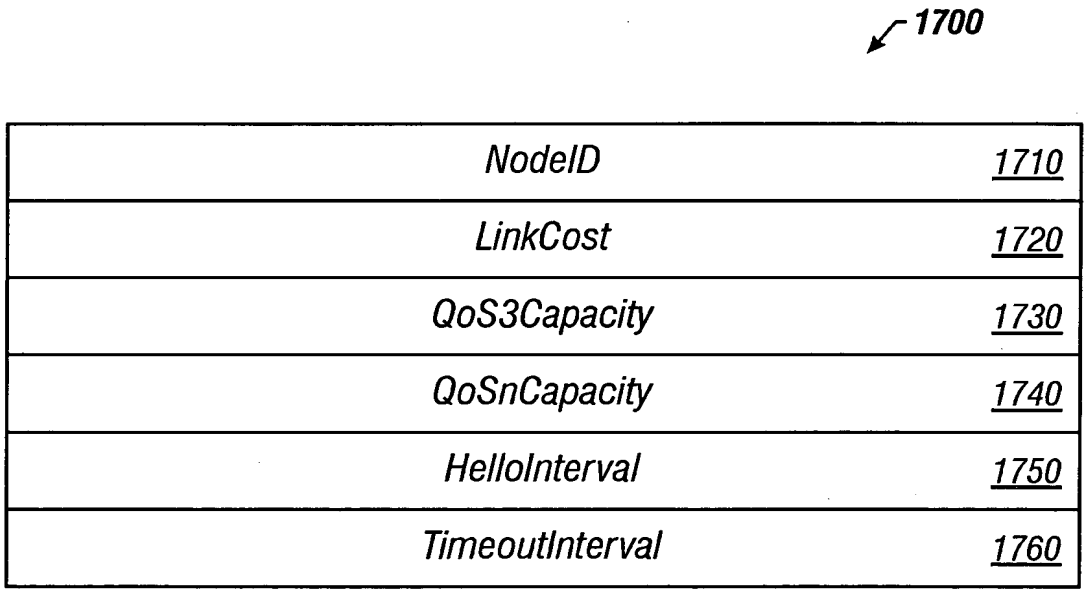

1700
NodeID 1710
LinkCost 1720
QoS3Capacity 1730
QoSnCapacity 1740
HelloInterval 1750
TimeoutInterval 1760

FIG. 17

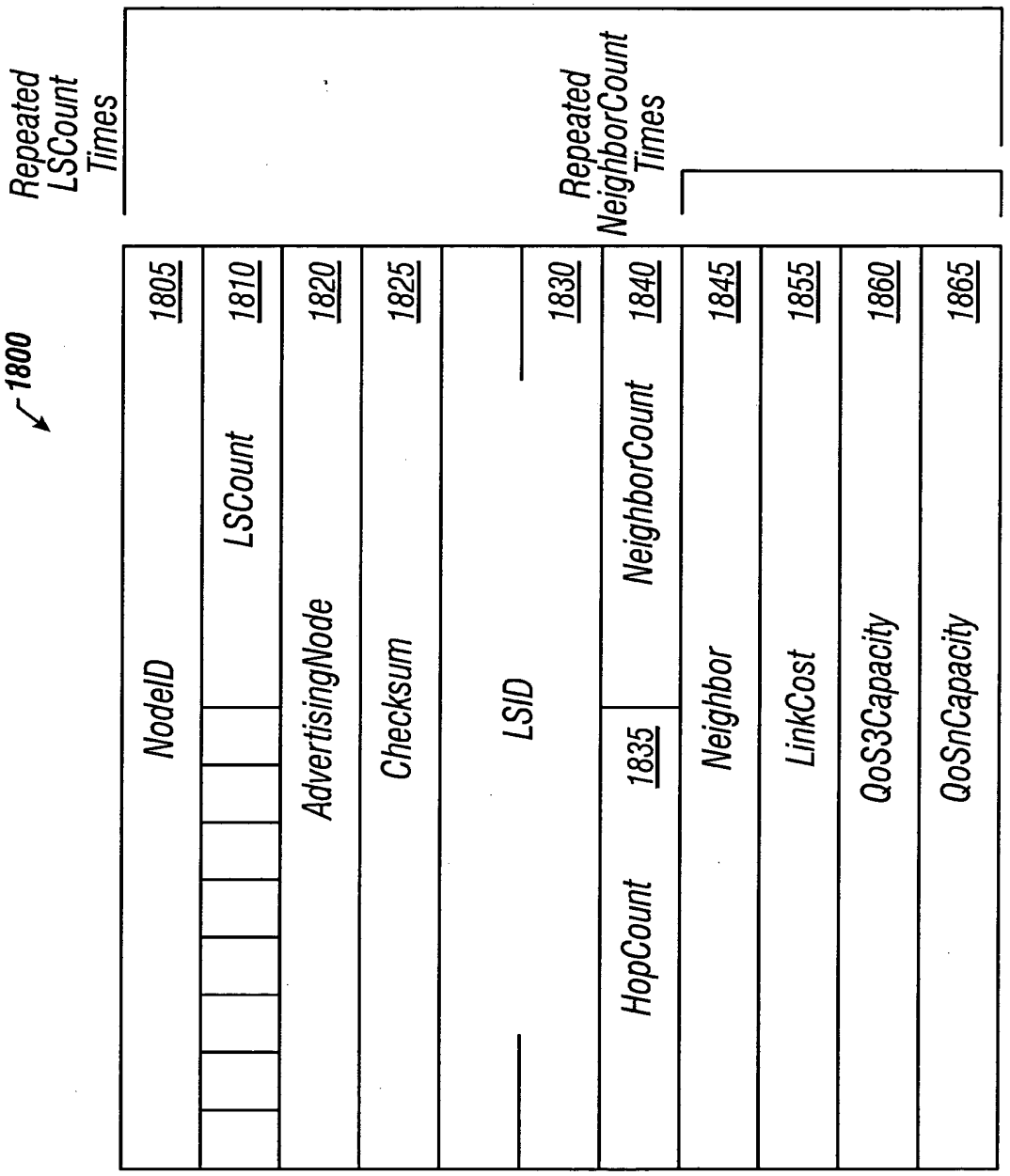

1800
Repeated LSCount Times
Repeated NeighborCount Times
NodeID 1805
LSCount 1810
AdvertisingNode 1820
Checksum 1825
LSID 1830
HopCount 1835
NeighborCount 1840
Neighbor 1845
LinkCost 1855
QoS3Capacity 1860
QoSnCapacity 1865

FIG. 18

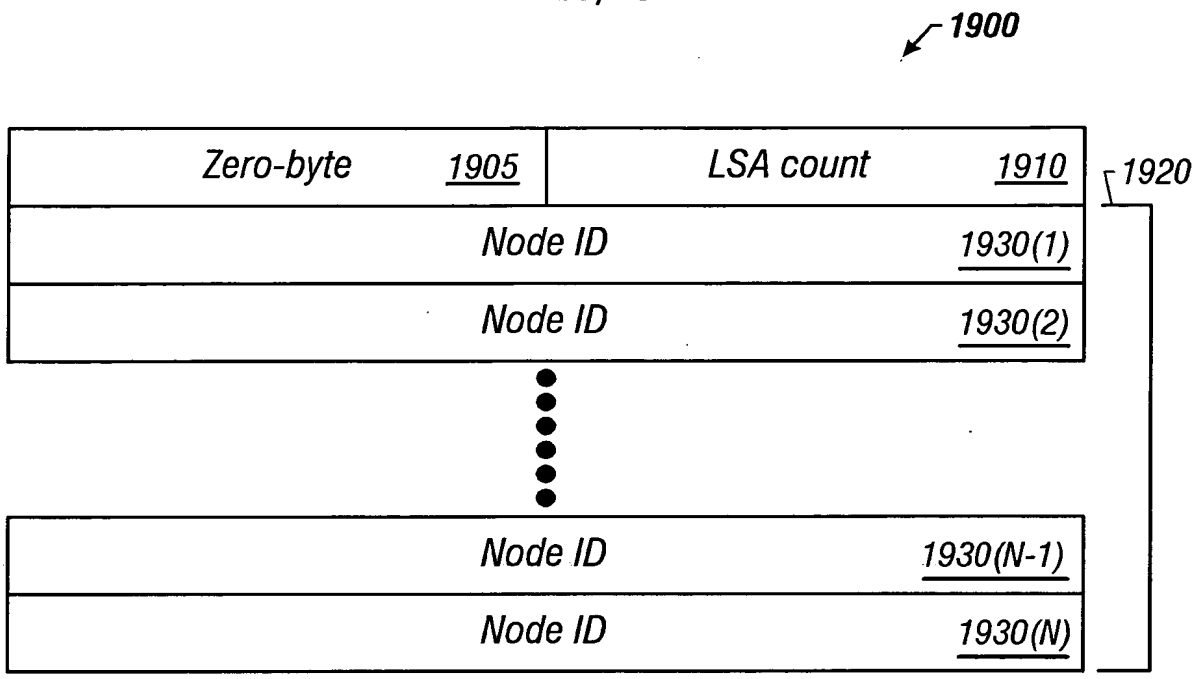

1900
Zero-byte
1905
LSA count
1910
1920
Node ID
1930(1)
Node ID
1930(2)
Node ID
1930(N-1)
Node ID
1930(N)

FIG. 19

2000

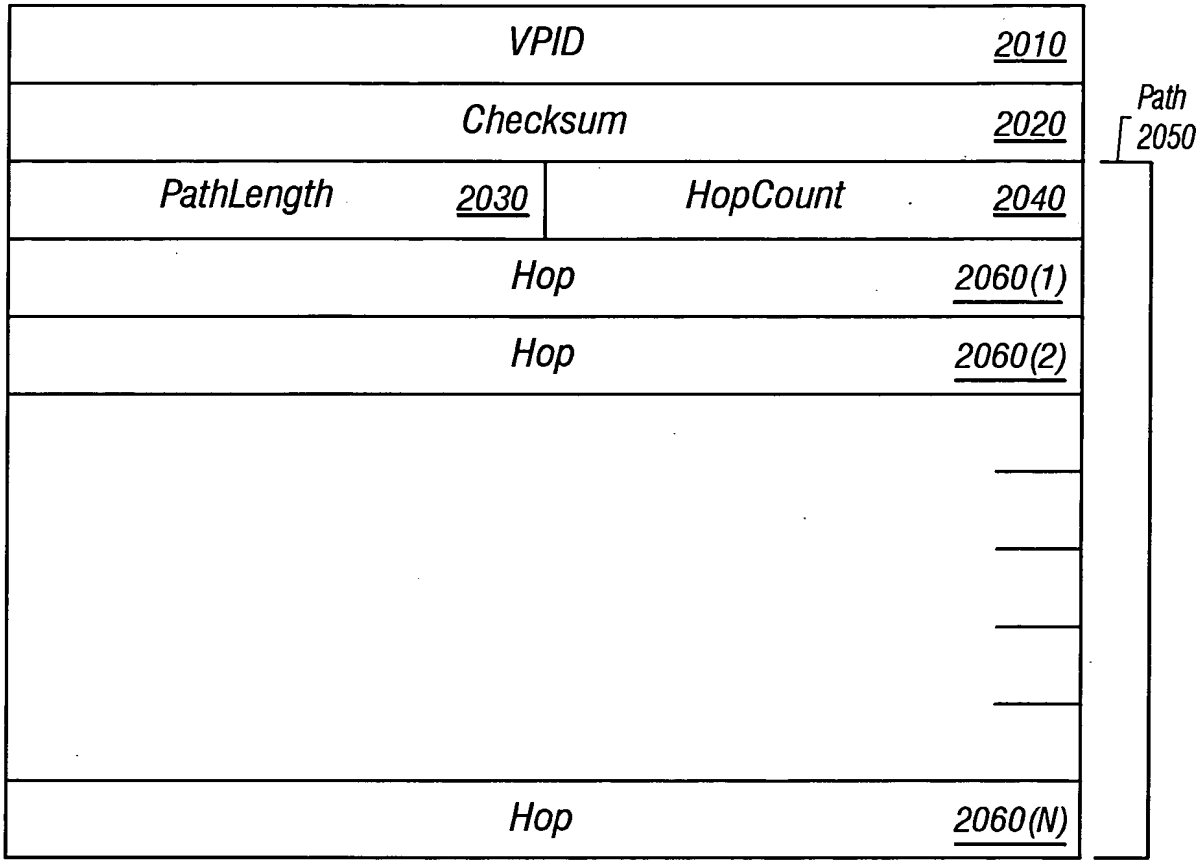

VPID
2010
Checksum
2020
PathLength
2030
HopCount
2040
Hop
2060(1)
Hop
2060(2)
Hop
2060(N)
Path
2050

FIG. 20

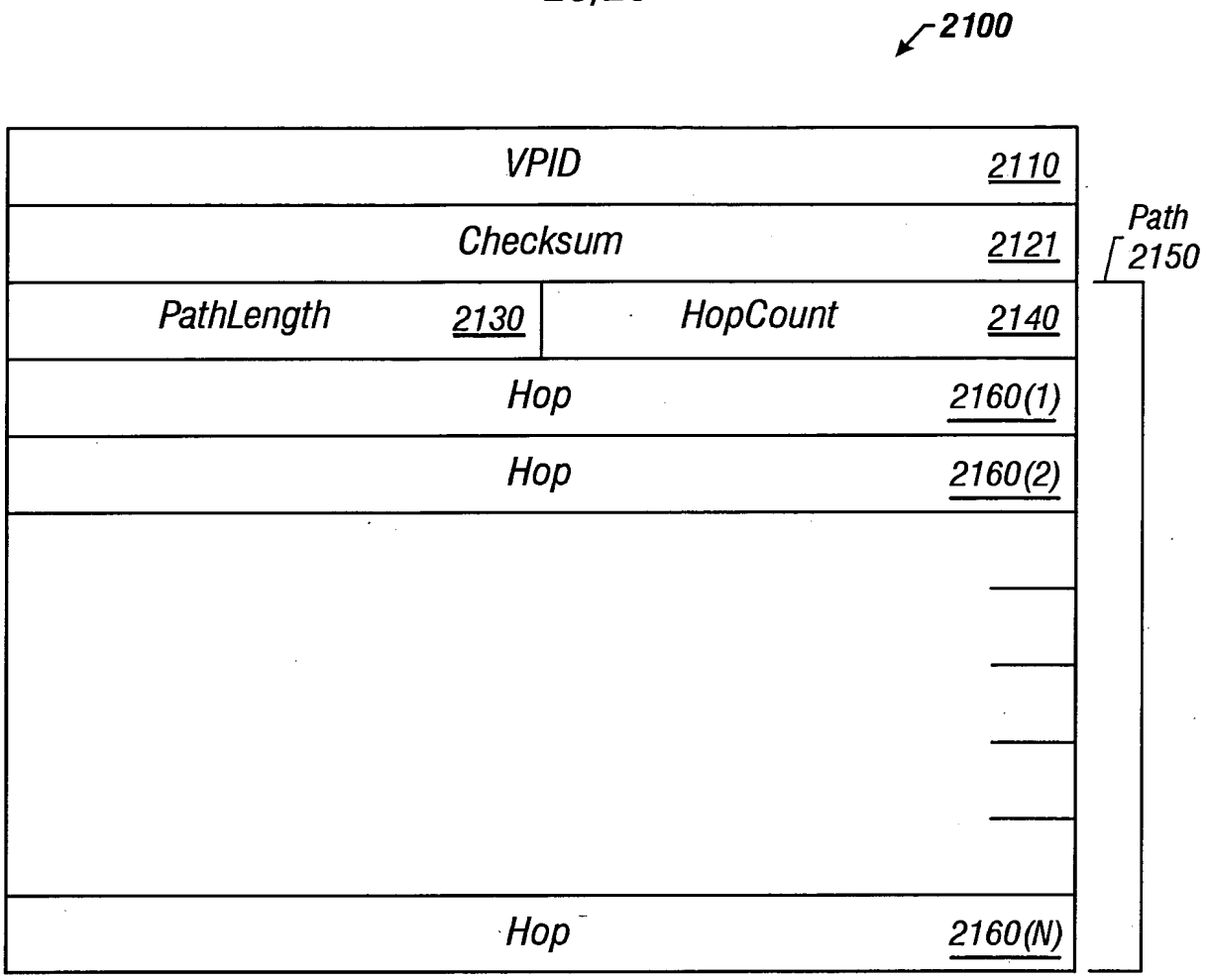

2100
VPID
2110
Checksum
2121
Path
2150
PathLength
2130
HopCount
2140
Hop
2160(1)
Hop
2160(2)
Hop
2160(N)

FIG. 21

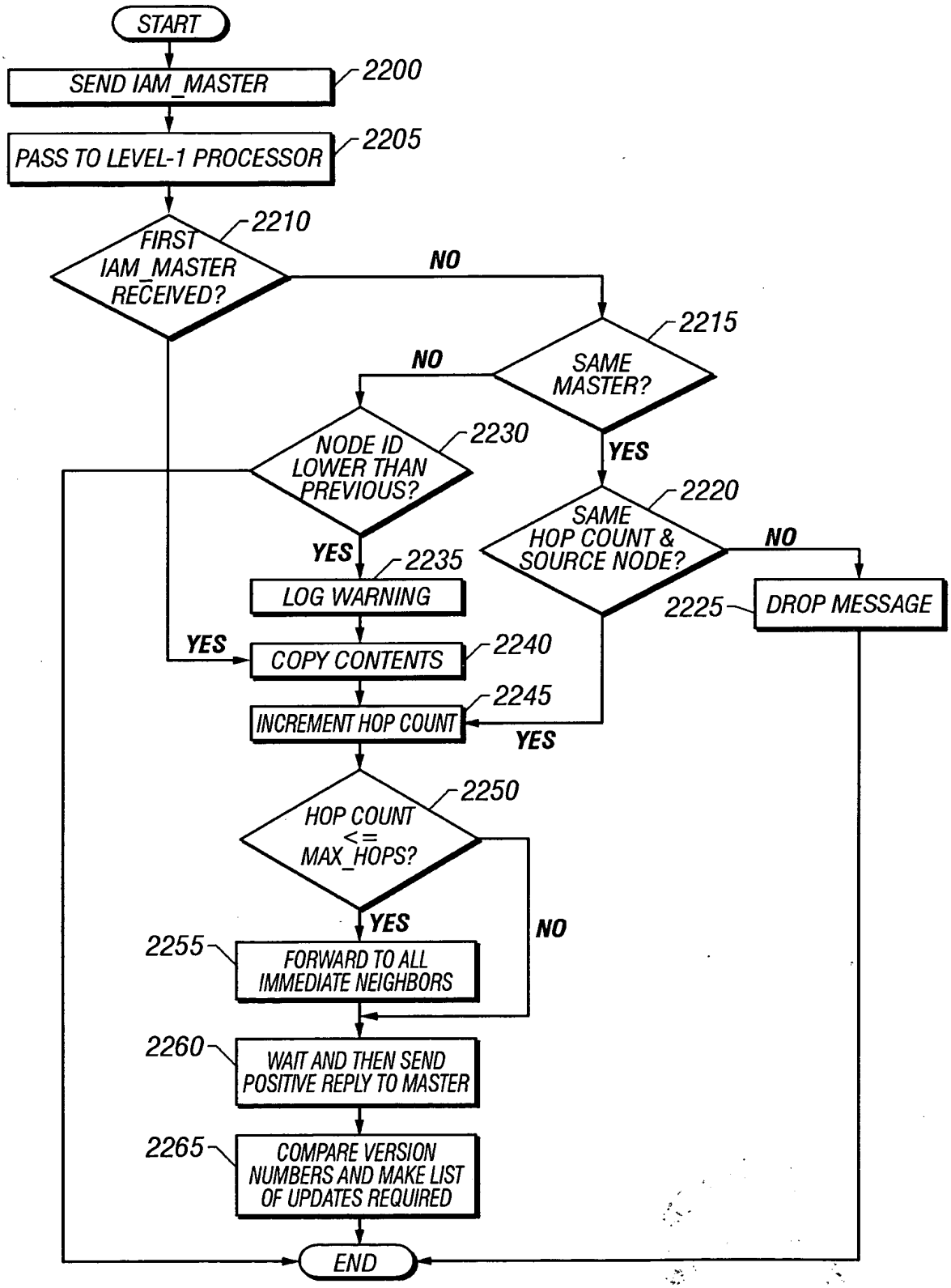

START
SEND IAM_MASTER
2200
PASS TO LEVEL-1 PROCESSOR
2205
FIRST IAM_MASTER RECEIVED?
2210
NO
SAME MASTER?
2215
NO
YES
NODE ID LOWER THAN PREVIOUS?
2230
SAME HOP COUNT & SOURCE NODE?
2220
NO
YES
LOG WARNING
2235
DROP MESSAGE
2225
YES
COPY CONTENTS
2240
INCREMENT HOP COUNT
2245
YES
HOP COUNT <= MAX_HOPS?
2250
YES
NO
FORWARD TO ALL IMMEDIATE NEIGHBORS
2255
WAIT AND THEN SEND POSITIVE REPLY TO MASTER
2260
COMPARE VERSION NUMBERS AND MAKE LIST OF UPDATES REQUIRED
2265
END

FIG. 22

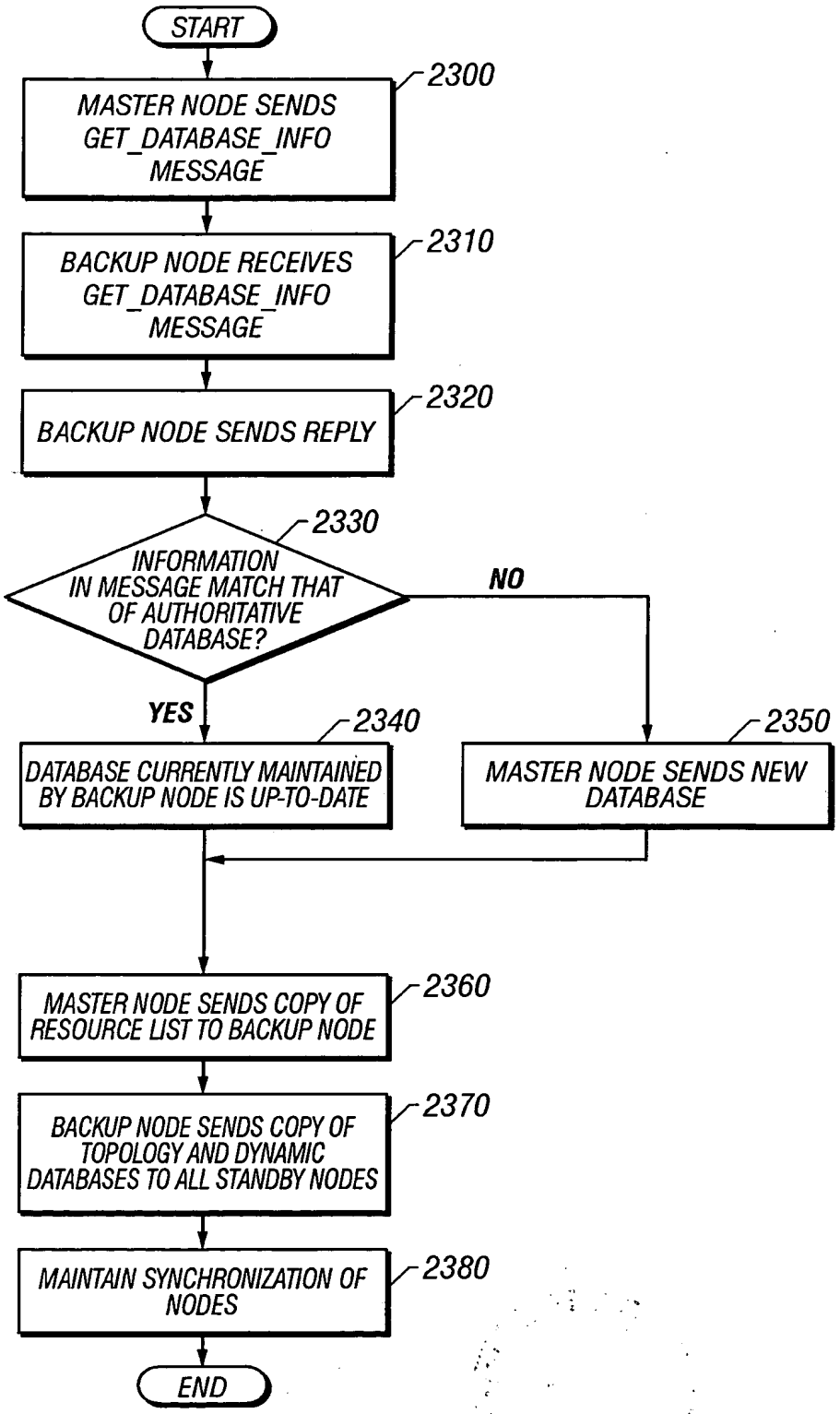

START
MASTER NODE SENDS GET_DATABASE_INFO MESSAGE
2300
BACKUP NODE RECEIVES GET_DATABASE_INFO MESSAGE
2310
BACKUP NODE SENDS REPLY
2320
INFORMATION IN MESSAGE MATCH THAT OF AUTHORITATIVE DATABASE?
2330
NO
YES
DATABASE CURRENTLY MAINTAINED BY BACKUP NODE IS UP-TO-DATE
2340
MASTER NODE SENDS NEW DATABASE
2350
MASTER NODE SENDS COPY OF RESOURCE LIST TO BACKUP NODE
2360
BACKUP NODE SENDS COPY OF TOPOLOGY AND DYNAMIC DATABASES TO ALL STANDBY NODES
2370
MAINTAIN SYNCHRONIZATION OF NODES
2380
END

FIG. 23

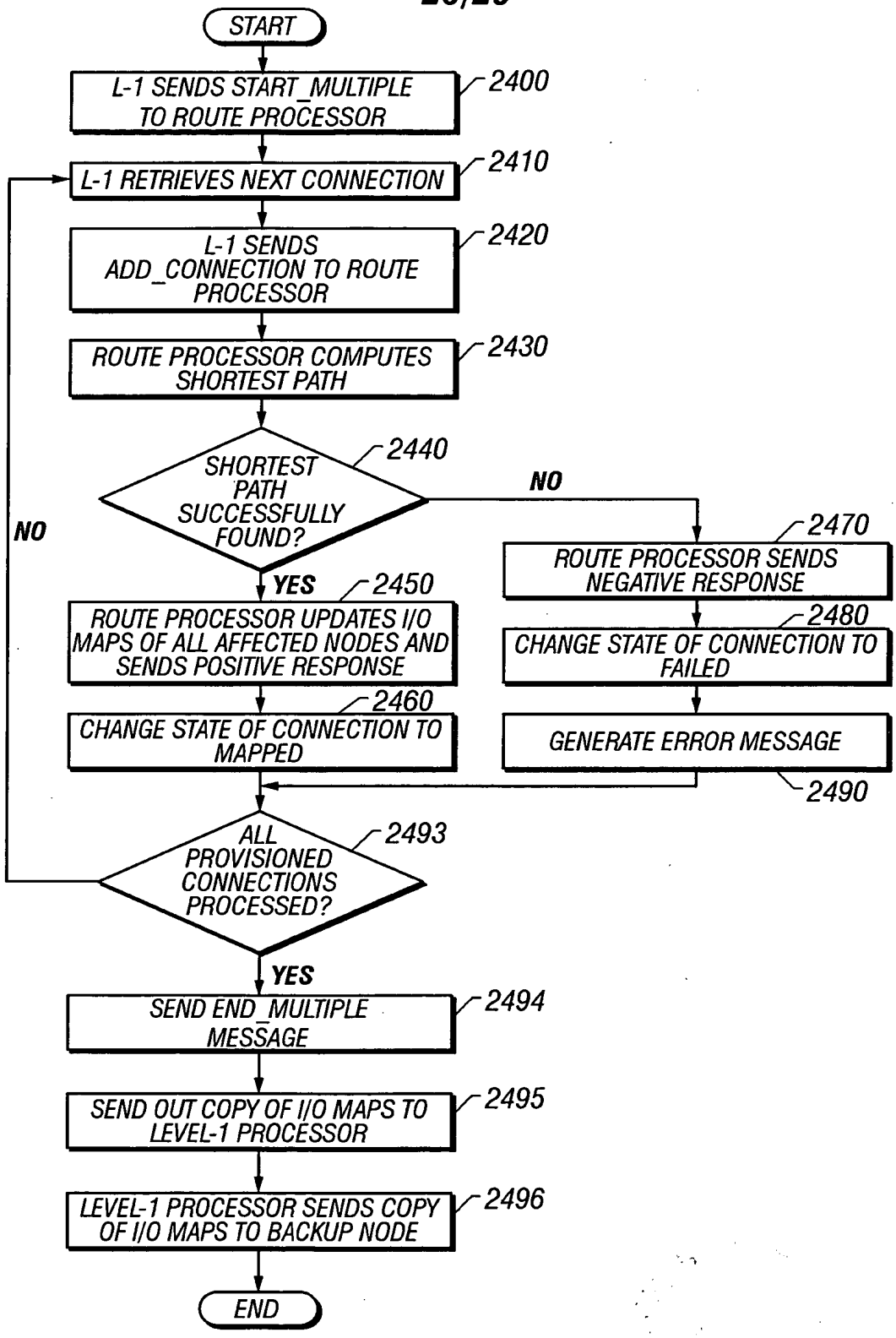

START
L-1 SENDS START_MULTIPLE TO ROUTE PROCESSOR
2400
L-1 RETRIEVES NEXT CONNECTION
2410
L-1 SENDS ADD_CONNECTION TO ROUTE PROCESSOR
2420
ROUTE PROCESSOR COMPUTES SHORTEST PATH
2430
SHORTEST PATH SUCCESSFULLY FOUND?
2440
NO
YES
NO
ROUTE PROCESSOR SENDS NEGATIVE RESPONSE
2470
CHANGE STATE OF CONNECTION TO FAILED
2480
GENERATE ERROR MESSAGE
2490
ROUTE PROCESSOR UPDATES I/O MAPS OF ALL AFFECTED NODES AND SENDS POSITIVE RESPONSE
2450
CHANGE STATE OF CONNECTION TO MAPPED
2460
ALL PROVISIONED CONNECTIONS PROCESSED?
2493
YES
SEND END_MULTIPLE MESSAGE
2494
SEND OUT COPY OF I/O MAPS TO LEVEL-1 PROCESSOR
2495
LEVEL-1 PROCESSOR SENDS COPY OF I/O MAPS TO BACKUP NODE
2496
END

FIG. 24

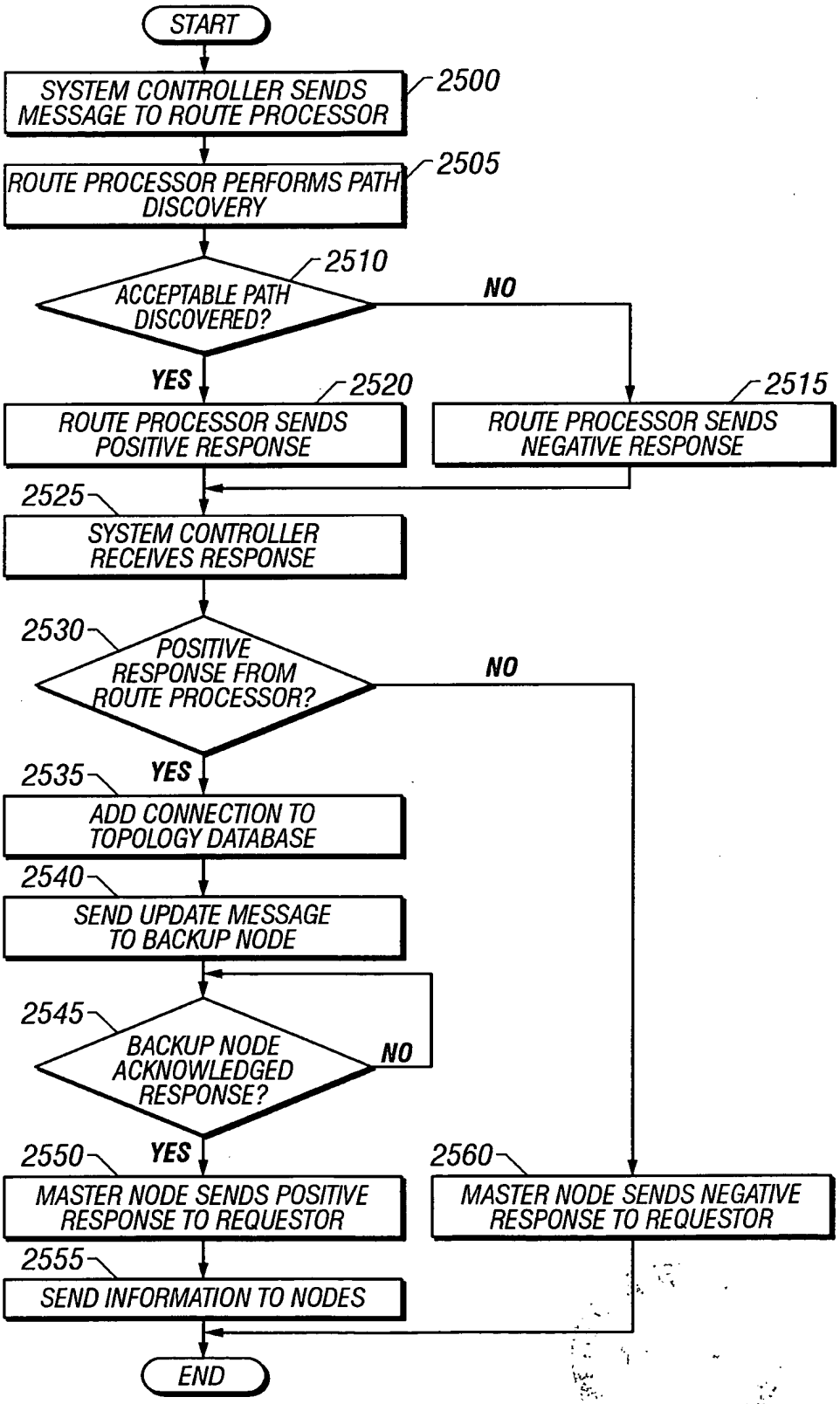

START
SYSTEM CONTROLLER SENDS MESSAGE TO ROUTE PROCESSOR
2500
ROUTE PROCESSOR PERFORMS PATH DISCOVERY
2505
ACCEPTABLE PATH DISCOVERED?
2510
NO
YES
ROUTE PROCESSOR SENDS POSITIVE RESPONSE
2520
ROUTE PROCESSOR SENDS NEGATIVE RESPONSE
2515
SYSTEM CONTROLLER RECEIVES RESPONSE
2525
POSITIVE RESPONSE FROM ROUTE PROCESSOR?
2530
NO
YES
ADD CONNECTION TO TOPOLOGY DATABASE
2535
SEND UPDATE MESSAGE TO BACKUP NODE
2540
BACKUP NODE ACKNOWLEDGED RESPONSE?
2545
NO
YES
MASTER NODE SENDS POSITIVE RESPONSE TO REQUESTOR
2550
MASTER NODE SENDS NEGATIVE RESPONSE TO REQUESTOR
2560
SEND INFORMATION TO NODES
2555
END

FIG. 25

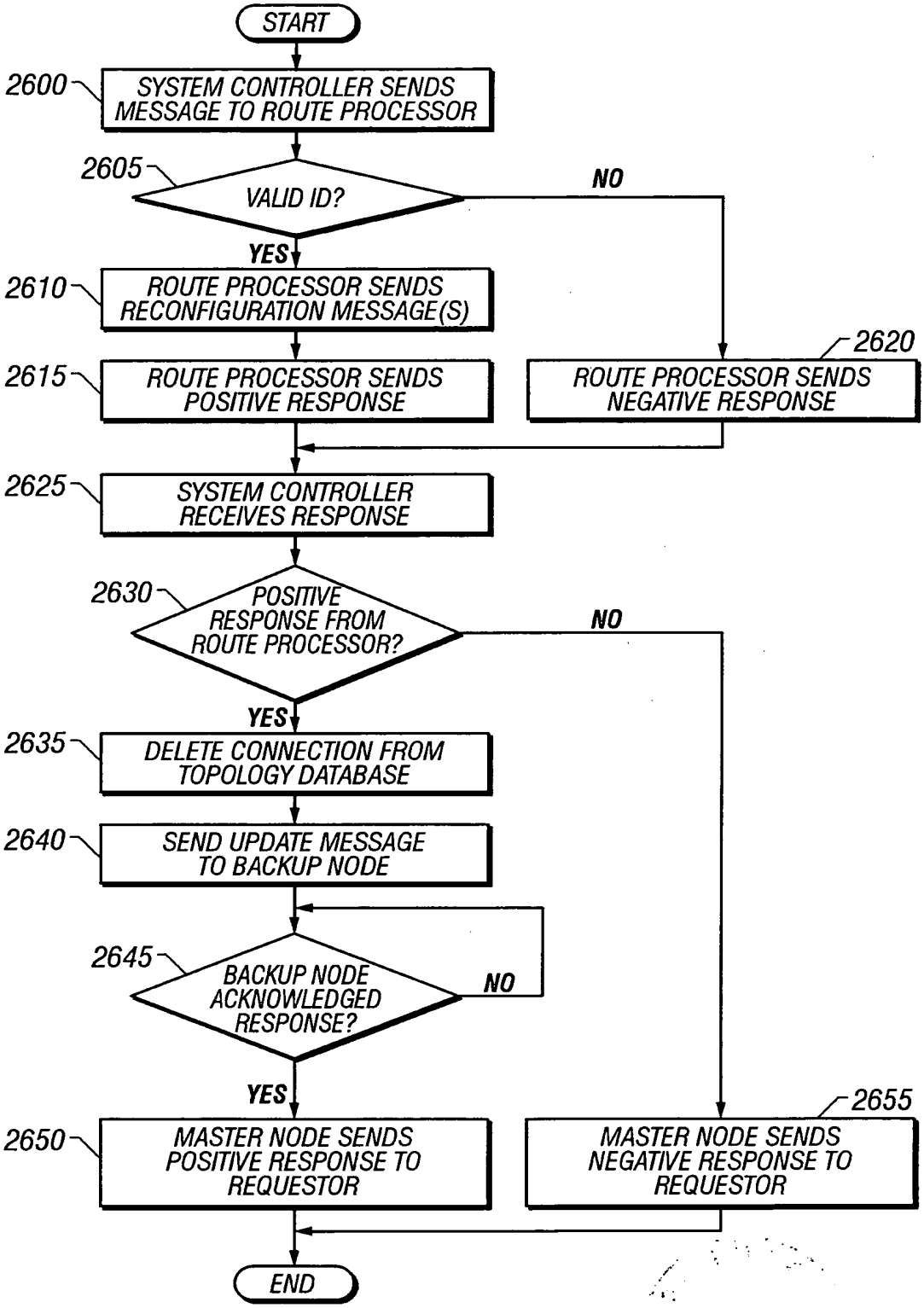

START
2600
SYSTEM CONTROLLER SENDS MESSAGE TO ROUTE PROCESSOR
2605
VALID ID?
NO
YES
2610
ROUTE PROCESSOR SENDS RECONFIGURATION MESSAGE(S)
2615
ROUTE PROCESSOR SENDS POSITIVE RESPONSE
2620
ROUTE PROCESSOR SENDS NEGATIVE RESPONSE
2625
SYSTEM CONTROLLER RECEIVES RESPONSE
2630
POSITIVE RESPONSE FROM ROUTE PROCESSOR?
NO
YES
2635
DELETE CONNECTION FROM TOPOLOGY DATABASE
2640
SEND UPDATE MESSAGE TO BACKUP NODE
2645
BACKUP NODE ACKNOWLEDGED RESPONSE?
NO
YES
2650
MASTER NODE SENDS POSITIVE RESPONSE TO REQUESTOR
2655
MASTER NODE SENDS NEGATIVE RESPONSE TO REQUESTOR
END

FIG. 26

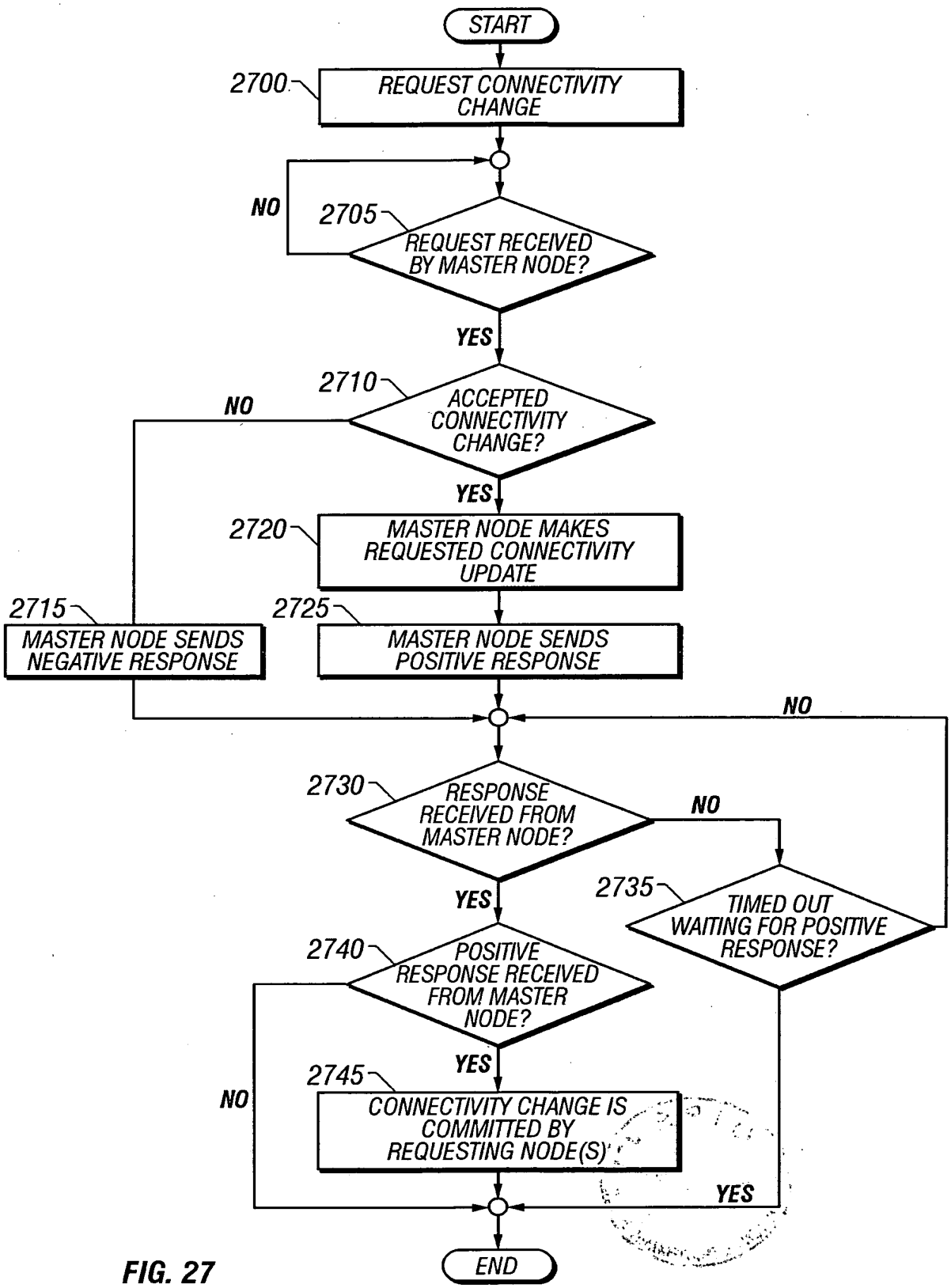

START
2700
REQUEST CONNECTIVITY CHANGE
NO
2705
REQUEST RECEIVED BY MASTER NODE?
YES
2710
ACCEPTED CONNECTIVITY CHANGE?
NO
YES
2720
MASTER NODE MAKES REQUESTED CONNECTIVITY UPDATE
2715
MASTER NODE SENDS NEGATIVE RESPONSE
2725
MASTER NODE SENDS POSITIVE RESPONSE
NO
2730
RESPONSE RECEIVED FROM MASTER NODE?
NO
2735
TIMED OUT WAITING FOR POSITIVE RESPONSE?
YES
2740
POSITIVE RESPONSE RECEIVED FROM MASTER NODE?
YES
2745
NO
CONNECTIVITY CHANGE IS COMMITTED BY REQUESTING NODE(S)
YES
END

FIG. 27